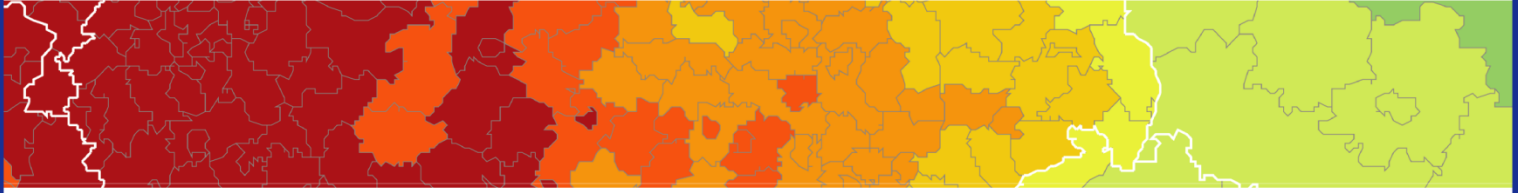


Inspire policy making by territorial evidence



CIRCTER – Circular Economy and Territorial Consequences

Applied Research

Final Report

Annex 5

Case Study synthesis report

Version 09/05/2019

Final Report

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Abbreviations

B2B	business-to-business
B2C	Business to Consumer
C2C	Consumer to Consumer
CBM	Circular Business Model
CDC	Caisse des dépôts et consignations
CE	Circular Economy
CEAP	Circular Economy Action Plan
CER	European Remanufacturing Council
CLD	Causal Loop Diagram
DEU	Domestic Extraction Used
DMC	Domestic Material Consumption
DMI	Direct Material Input
EC	European Commission
EEA	European Environmental Agency
EMAS	European Monitoring and Audit Scheme
EMF	Ellen MacArthur Foundation
EPR	Extended Producer Responsibility
ERDF	European Regional Development Fund
ESPON	European Territorial Observatory Network
EU	European Union
GDP	Gross Domestic Product
GPP	Green Public Procurement
GWR	Geographically Weighted Regression
JRC	Joint Research Centre
IS	Industrial Symbiosis
LMM	Last Minute Market
MBT	Mechanical-Biological Treatment
MFA	Material Flow Analysis
MS	Member States
MSW	Municipal Solid Waste
NACE	Nomenclature of Economic Activities
NUTS	Nomenclature of Territorial Units for Statistics
OLS	Ordinary Least Squares/Linear Regression
OVAM	Public Waste Agency of Flanders
P2B	Peer-to-business
P2P	Peer-to-peer
PPP	Purchasing Power Parity
RMC	Raw Material Consumption
RMI	Raw Material Input
ResCoM	Resource Conservative Manufacturing
SME	Small and Medium Enterprises
RIS3	Regional Innovation Strategies for Smart Specialisation
ToR	Terms of Reference
WEEE	Waste from Electrical and Electronic Equipment

1 Introduction

Case studies in CIRCTER are aimed at taking stock and grasping what has been done and what can be done in relation to implementing a circular economy in European regions, cities and metropolitan areas. The case studies create an integrative narrative of (1) how circular economy works in real conditions, (2) how regional factors can unlock the circular economy potential and the contribution of circular economy to territorial development, and; (3) illustrate key patterns and trends of material flows. Besides, they unveil the power of a right set of framework conditions to invigorate the transformation into a circular economy (including e.g. finance, research, education and other policy measures to stimulate changes in production and consumption patterns, etc.).

Case studies are part of a broader work in the CIRCTER project that examines the territorial consequences of circular economy and have made significant contributions to other tasks of the project. In particular, the lessons learned in the case studies have been a fundamental input to build the Closed Loop Diagrams (CLD) presented in Annex 4, and to provide policy guidance for a circular economy at sub-national levels (see annexes 5 and 6).

2 Methodology

This chapter describes the process and methods to select and draft the case studies.

2.1 Selection of case studies

The number of countries, regions and cities that has decided to move towards a circular economy is growing meaningfully in the last years. Numerous initiatives are highlighted as good practices in multiple databases, reports and web-based platforms. The CIRCTER partners singled out 20 cases as potential cases studies. The candidates were assessed against a set of selection criteria prior to the selection the six cases that better serve the CIRCTER goals and expectations. Next, the selection process is described in detail.

2.1.1 Identification of case studies candidates

Case studies candidates were identified based on the partners' knowledge about good examples of how circular economy works in reality, and revision of existing good practice databases (see some examples in Box 2-1).

Box 2-1 Example of existing circular economy good practice databases

Circular Europe Network (CEN): A specific initiative on circular economy planning by cities and regions launched by ACR+. The network builds on the expertise of European front runners within the ACR+ network to gather, analyse and exchange information on efficient circular economy strategies. <http://www.circular-europe-network.eu/>

Circulator – The circular business model mixer: A project funded by EIT Raw Materials aimed at supporting aspiring entrepreneurs in making conscious strategic choices regarding the sustainability of their business model and value proposition. It includes a case browser: <http://www.circulator.eu/browse-the-cases>

The **Ellen MacArthur Foundation's** website includes a database of case studies <https://www.ellenmacarthurfoundation.org/case-studies>

Circulars, an initiative of the World Economic Forum and the Forum of Young Global Leaders, run in collaboration with Accenture Strategy, is a circular economy award program. The award offers recognition to individuals and organizations across the globe that are making notable contributions to the circular economy in the private sector, public sector and society. The awarded companies (there is a category dedicated to SMEs) can be checked here: <https://thecirculars.org/>

This work resulted in a list of twenty case studies candidates (see Table 2-1).

Table 2-1 Long list of case studies candidates

Label	Main Feature	Country
Brussels Regional Program for a circular economy 2016 – 2020 (BRPCE)	Big front-running city / metro area, overarching governance	BE
Liguria Circular	Permanent exchange platform on the circular economy	IT
Lombardia Circular	circular economy in RIS3 (includes Advanced Manufacturing)	IT
Scotland strategy for circular economy - Making things last	Regional strategy/mission orientation towards the CE	UK
Porto - Waste as a resource	Bio economy, waste management, reuse, community engagement	PT
Košice - circular economy and the local steel industry	Transition to a circular economy in the local steel industry.	SK
Sicily - Industrial symbiosis	The first industrial symbiosis in Italy	IT
Transition to industrial symbiosis in Budapest	Industrial symbiosis	HU
Maribor and the industrial WCYCLE project	Sustainable materials management	SI
QUIB - The circular economy workspace	Promotion of cradle-to-cradle design and circular economy production principles	RO

Paris Economie Circulaire	Food. Product-Service system, Industrial symbiosis	FR
Basque Country circular economy initiatives	circular economy business models	ES
Bio economy cluster in Central Germany	Bio economy	DE
Zero waste Emilia-Romagna	Waste management, reuse	IT
Satakunta Bio economy	Bio economy	FI
Luxembourg CE	Transition based on its small size and spirit of co-creation and cooperation,	LU
Flanders Materials Programme	Public-private partnership. Ambitious long-term vision. Winner of Circulars 2016	BE
Circular Amsterdam	The first Circle city scan. Roadmap.	NL
Barcelona - Sharing Economy	Sharing economy	ES
Kalundborg industrial symbiosis	Industrial symbiosis	DK

2.1.2 Case studies selection rationale

Several criteria were agreed to guide us through the selection of a well-balanced set of case studies in terms of type of territory, geography and history, and circular economy approach:

- **SC1. Illustrate different geographical and historical contexts:** Regions and cities from different European realities in terms of geography, historical and cultural legacy, economy, etc.
- **SC2. Represent different types of territories:** In order to exemplify the shift towards a circular economy in urban and rural areas, border regions, islands and sparsely populated regions, as well as in capital cities, secondary growth poles and small and medium sized towns.
- **SC3. Exemplify the various approaches towards reaching a Circular Economy in a variety of sectors:** Sustainable materials management, new circular economy business models, industrial symbiosis, bioeconomy, along with well-thought governance structures will be investigated. The analysed sectors include, among others, construction, plastics, agriculture and transport. This, along with the diverse territories incorporated to the pool of cases, allows observing the interplay among the territorial features and the various angles of such a transformation. as well as gaining lessons for future policy development.

Besides, we also investigated the following factors to single out the six cases to be drafted in CIRCTER:

- **SC4. Leadership towards the CE:** This allows grasping the major success factors, but also learning about how the challenges and difficulties were handled.
- **SC5. Demonstrated evolution and/or potential:** Established circular economy initiatives are combined with more recent initiatives with demonstrated capacity in making full use of the circular economy potential.
- **SC6. Well-thought governance structure and leadership:** The selected cases exemplify diverse governance and leadership solutions, ranging from single to collaborative leadership, as well as various forms of public-private collaboration.
- **SC7. Availability and accessibility** to relevant information and studies, data and key stakeholders: This is crucial to perform an in-depth analysis of the selected cases.

Table 2-2 shows the outcome of assessing the best practice candidates against the above described selection criteria

Table 2-2 Assessment of the case studies candidates against the selection criteria

Title and brief description	MS	Country (N) / Region(R) / City (C)	Type of R ⁽¹⁾	SC1-3		SC4	SC5	SC6	SC7
				Type of CI ⁽²⁾	Sector and circular economy approach	Leadership towards the CE	Evolution/potential	Governance	Availability/Accessibility to information
Brussels Regional Program for a circular economy 2016 – 2020 (BRPCE)	BE	C		Capital city	Construction, resources and waste, logistics, retail business	√√√	√√√	√√√	√√√
Liguria Circular	IT	R	Peri-urban		Permanent exchange platform on the circular economy	√√	√√	√√√	√√
Lombardia Region – circular economy	IT	R	Peri-urban		circular economy in RIS3 (includes Advanced Manufacturing)	√√	√√	√√√	√√
Scotland strategy for circular economy - Making Things Last	UK	R	Interm., Spars. pop		Bioeconomy, construction, re-manufacturing	√√√	√√√	√√√	√√√
Oporto	PT	C		Secondary growth pole	Bioeconomy, waste management, reuse, community engagement	√√√	√√	√√√	√√√
Košice	SK	C		Secondary growth pole	Steel & automotive, construction	√	√√	√	√
Sicily industrial symbiosis	IT	R	Island		Waste from processing stone materials, construction and the demolition waste; plastics; bio-waste	√√	√√√	√√	√√√
Transition to industrial symbiosis in Budapest	HU	C		Capital city	Industrial symbiosis	√	√√	√√	√√
Maribor and the industrial WCYCLE project	SI	C		Second growth pole	Construction, agriculture, transport, tourism, water. Material recovery, recycling	√	√√	√√√	√√√

QUIB The circular economy workspace	RO	C		Small and medium-sized towns	Promotion of cradle-to-cradle design and circular economy production principles	✓	✓✓	✓✓	✓✓
Paris Economie Circulaire	FR	C		Capital city	Food. Product-Service system, Industrial symbiosis	✓✓✓	✓✓✓	✓✓✓	✓✓✓
Basque Country circular economy initiatives	ES	R		Predom. Urban Border	Eco-design, servitisation, re-manufacturing	✓✓	✓✓✓	✓✓✓	✓✓✓
Bio Economy Cluster in Central Germany	DE	R		Predom. Urban	Woods, materials, chemistry, energy	✓✓✓	✓✓✓	✓✓✓	✓✓✓
Zero waste Emilia Romagna	IT	R		Predom. Urban	Waste management-reuse	✓✓	✓✓✓	✓✓	✓✓✓
Satakunta	FI	R		Predom. rural	Bio economy	✓✓✓	✓✓✓	✓✓✓	✓
Luxembourg CE	LU	N		Predom. urban	Reuse of secondary raw materials, eco-design, reverse logistics management.	✓✓✓	✓✓✓	✓✓✓	✓✓✓
Flanders Materials Programme	BE	R		Predom. Urban	PPP: combination of ambitious long-term vision development, policy research and action in the field	✓✓✓	✓✓✓	✓✓✓	✓✓✓
Circular Amsterdam	NL	C		Capital city	Quantification of circular economy opportunities. Food and construction chains	✓✓✓	✓✓✓	✓✓✓	✓✓✓
Barcelona Sharing economy	ES	C		Secondary growth pole	Sharing economy	✓✓✓	✓✓✓	✓✓✓	✓✓✓
Kalundborg industrial symbiosis	DK	C		Small and medium-sized town	Since 1972. The world's first industrial symbiosis with a circular approach to production	✓✓✓	✓✓✓	✓✓✓	✓✓✓

2.1.3 Selected case studies

The selected cases (see Table 2-3) represent different types of territories, geographical and historical contexts, and exemplify a wide range of motivations and approaches to transform the way we produce and consume. Similarly, the cases illustrate diverse leadership and governance, ranging from single to collaborative leadership, as well as various forms of public-private collaboration. But they all share a meaningful commitment to shift from a linear to a circular economy.

Table 2-3 CIRCTER case studies

Main feature	Label	MS	R/C ⁽¹⁾	Type of R ⁽²⁾	Type of C ⁽³⁾	Sector and circular economy approach	CIRCTER PARTNER
Regional strategy/mission orientation towards the CE	Scotland strategy for circular economy - Making Things Last	UK	R	Interm., sparsely pop		Bioeconomy, construction. Remanufacture	PROGNOS
Sustainable materials management	Maribor and the industrial WCYCLE project	SI	C	Predom. urban	Secondary growth pole	Construction, agriculture, transport, tourism, water. Material recovery, recycling	ACR+
Big front-running city / metro area, overarching governance	Brussels Regional Program for a circular economy 2016-2020 (BRPCE)	BE	C	Predom. urban	Capital city	Construction, resources and waste, logistics, retail business	TECHNOPO-LIS
New circular economy business models	Basque Country circular economy initiatives	ES	R	Predom. urban		Eco-design, servitisation, re-manufacturing	TECNALIA
Industrial symbiosis	Sicily – The first industrial symbiosis platform in Italy	IT	R	Island		Wastes from processing stone materials, construction and the demolition waste; plastics; bio-waste	KE
Bioeconomy	BioEconomy Cluster in Central Germany	DE	R	Predom. urban		Woods, materials, chemistry, energy	WI

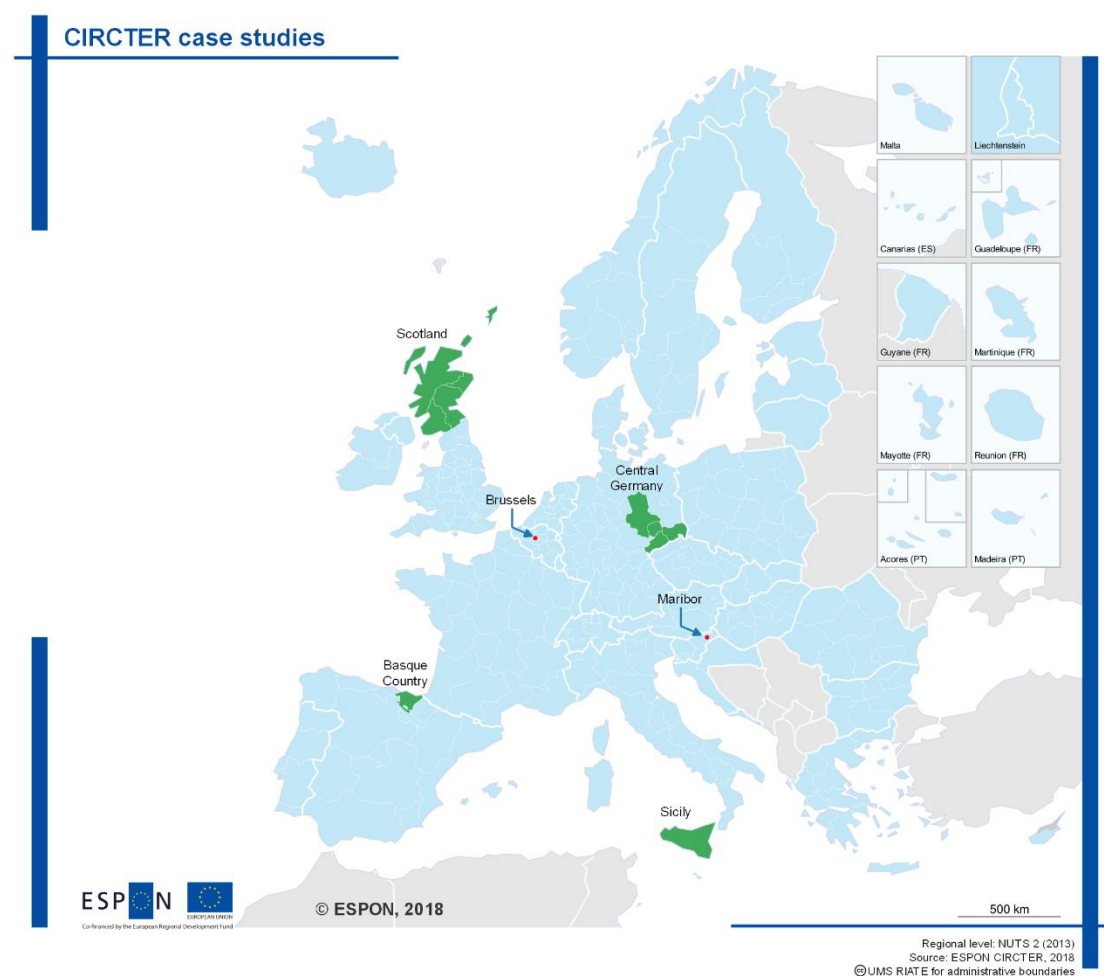
(1) R: Regional initiative; C: City-level initiative

(2) Type of Region: urban-rural (predominantly urban, intermediate and predominantly rural), islands, border regions (internal or external) and sparsely populated regions

(3) Type of City: capital cities, secondary growth poles, small and medium sized towns

The selected cases are well distributed across Europe (see Map 2-1). While some of the case are already successful stories, others are newly established initiatives with expected capacity to untap the potential of a circular economy soon. Each CIRCTER partner was in charge of drafting of one case study. The geographical proximity, the language skills, as well as easy access to key stakeholders, have been taken into consideration when distributing the case studies within the partnership.

Map 2-1 CIRCTER case studies

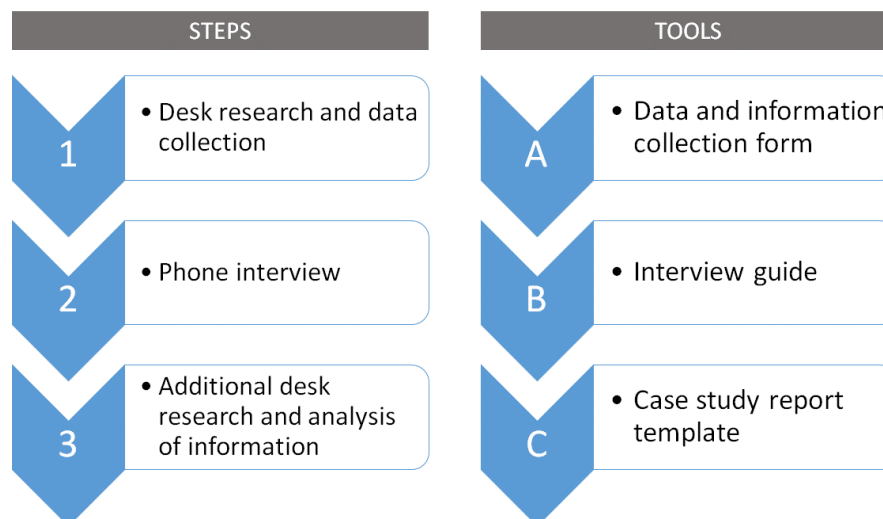


2.2 Drafting of case studies

The drafting of the in-depth case studies has been done through the step-wise process shown in Figure 2-1. The partners were assisted through the process with a set of tools ('Data and information collection form', an 'Interview guide', and a 'Case study report template') that are available in Annexes 1 to 3. Step 1 was aimed at taking stock and reviewing previous studies/reports about the case study. It consisted of a quick revision of secondary sources. Step 2 sought to validate and complete the information gained in the desk research, as well as to

explore the reasoning behind the findings. The main findings of Steps 1 and 2 laid the ground for the elaboration of the Case Study reports (Step 3).

Figure 2-1 Case study drafting steps and tools



Source: Own elaboration

Draft case studies (ready by the end of June 2018) were incorporated to the Interim Report. Territorial aspects have been enhanced and consistency among the cases improved to elaborate the final versions of the case studies (see Annex 4). The partners reviewed more than 70 references and conducted the interviews shown in Table 2-4: to draft the cases.

Table 2-4: List of interviews conducted in the CIRCTER case studies

CASE STUDY	ORGANISATION	INTERVIEWEE POSITION/ROLE
Scotland – circular economy strategy “Making Things Last”	Zero Waste Scotland	Manager
Maribor - The WCYCLE strategy	WCYCLE Institute Maribor	Manager
	SNAGA	Management Consultant
Brussels Regional Plan for a circular economy 2016-2020 (BRPCE)	Brussels Environment	Manager
Basque Country circular economy initiatives	IHOBE, Basque Environmental Agency	Manager
	INNOBASQUE	Manager
Sicily – Industrial symbiosis	ENEA	Researcher
Central Germany – The Bioeconomy Cluster	Bioeconomy Cluster	Manager
	Helmholtz Centre for Environmental Research	Project coordinator
		Researcher

Source: own elaboration

3 The circular economy in the selected regions

After briefly describing the context in which the selected initiatives take place (Table 3-1) and giving an overview of the six case studies (Table 3-2), this chapter synthesises the key achievements and describes the hindering and enabling factors. It also assesses the transferability of the initiatives and the role played by the European Structural and Investment Funds (ESIF).

Table 3-1 Context information - Highlights

CASE STUDY	CONTEXT INFORMATION - HIGHLIGHTS
Scotland Circular economy strategy “Making Things Last”	<p>Before defining the Strategy, Scotland had outlined and implemented several policies and strategies that paved the way towards a Circular Economy Strategy</p> <p>Manufacturing plays an important role: products, such as in food, drinks, textiles or pharmaceuticals, represent half of international export and over 50% of R&D expenditures</p>
Maribor The WCYCLE strategy	<p>Maribor is the second largest city in the Republic of Slovenia (130,000 inhab.)</p> <p>The main sectors in Maribor are: Construction, agriculture, transport, tourism.</p> <p>The citizens have repeatedly expressed publicly that they do not want anymore any landfill or a waste incinerator</p> <p>Linked to the Integrated Sustainable Urban Development Strategy of Maribor: activation of local social and economic potential, sustainable urban mobility; urban regeneration</p>
Brussels Regional Plan for a circular economy 2016-2020 (BRPCE)	<p>Frontrunner city in the implementation of a strategy aiming to transition to the circular economy</p> <p>Largely service-oriented economy</p> <p>The extensive metabolism study conducted in 2013-2015 unveiled a highly linear economy and a strong dependence towards the outside concerning the resources it consumes. The study also highlighted the quantitative importance of certain flows, in particular those linked to the construction, agriculture and food sectors, and fuels and petroleum products</p>
Basque Country circular economy initiatives	<p>High population density. Predominantly urban region, diverse geography</p> <p>Spain is a quasi-federal country – Basque Government has significant competences in the environmental field</p> <p>Generates more waste than the EU average, and it seems to keep an increasing pace (although the recycling rates are close to the EU average)</p> <p>One of the most relevant industrial hotspots in Spain (industry means 24% of the GVA)</p> <p>- Traditional manufacturing activities such as metallurgy and machinery and equipment, as well as energy (and related manufacturing) as main activities</p> <p>Raw materials consumption is the main cost category in the industry’s cost structure</p>
Sicily – Industrial symbiosis	<p>The GDP per capita is below the Italian average. Unemployment is over the average</p> <p>A series of reforms and investments on agriculture- competitive industry at the national level and beyond.</p> <p>Tertiary sector has taken the lead (the economic growth used to be primarily driven by the industrial sector)</p> <p>Most of the industries are local (i.e. these satisfy local demand), in addition to tourism.</p> <p>Industrial production in Sicily is characterized by a few but important industrial centres.</p> <p>The main sectors of the economy that hold potential for waste recycle and reuse are agriculture and manufacturing.</p>
Central Germany – The Bioeconomy Cluster	<p>Unemployment rate (the highest in Germany in 2010) has dropped significantly</p> <p>Good soil for agriculture and forestry.</p> <p>Strong sectors: chemical industry, manufacture of machinery for processing and manufacture of plastics and rubber</p> <p>Small sized companies (compared to Germany, not so much if compared to other EU regions); Start-up intensity is lower than the national average</p> <p>Increasing shortage of skilled workers (in particular for small companies)</p> <p>Hub of research and development (especially in the chemical and biotechnology sectors) that could potentially provide key workforce for the circular bio economy.</p>

3.1 Overview of case studies

Table 3-2 Overview of case studies

CASE STUDY	SINCE	APPROACH & PRIORITIES	QUANTITATIVE TARGETS	OUTSTANDING MEASURES
Scotland – circular economy strategy “Making Things Last”	2010	-Food and drink, remanufacture, construction, energy infrastructure; -Design -Waste prevention (households and industry) -New skills, and new thinking culture -Longer lifetime for products	-Cut food waste by a third until 2025 -Worldwide leader in the shift to a circular economy	-New method to analyse and measure waste reductions based on a carbon accounting approach (measures the whole life carbon impact of waste, regardless of its geographical origin) -Charter for Household Recycling -Second-hand superstore -“Recycling on the go” to change lifestyles -Circular Economy Investment Fund: circular design projects and services, in collaboration between businesses and academia -Upskilling: Strategic agenda -Scottish Carbon Metric -The Scottish Institute for Remanufacture
Maribor - The WCYCLE strategy	2014	-Collaboration among public utility companies in the processing and re-use of material, energy and water waste resources	-Increase the recycling rate in 30% by 2023 -Increase the share of reusable waste (14% to 44%) by 2023 -Market for secondary raw materials	-Wcycle Institute – to promote collaboration among public utilities -New high-tech waste management plant – sorting and treating 200KT/year
Brussels Regional Plan for a circular economy 2016-2020 (BRPCE)	2013	-Logistics, waste, construction, food and retail -Economic opportunities of CE -Place-based economy -Create new jobs		-Business park -Link circular economy academic research in circular economy-work by public and private actors -Networking platforms -Monitoring scheme
Basque Country circular economy initiatives	2013	-Key metals and plastics, composites and rubber -A strong industry orientation -Eco-design, remanufacturing and advanced repair, servitisation and new business models	Expectations: to decrease 6% the raw material consumption and consequently saving 2,000 million euro by 2030.	-Green public/private procurement -Standardisation -Grants (eco-design, circular economy demonstration, industry 4.0. to drive a CE) -Financial support to equipment and infrastructure -Fiscal deductions -circular economy monitoring framework (built upon the European one)
Sicily – Industrial symbiosis	2011	-Agri-food and construction -Unlock the potential of industrial symbiosis in Sicily		-Online platform to launch industrial symbiosis: to analyse material and waste flow and identify potential matches for waste reuse -Guiding documents to implement the matches -Network of local stakeholders and companies - trust
Central Germany – The Bioeconomy Cluster	2012	To build a bioeconomy leading market		Foster joint innovation opportunities, share knowledge and support companies and research projects

3.2 Case studies and the CIRCTER indicators

This chapter shows the values of the CIRCTER indicators for the NUTS2 regions that are relevant CIRCTER case studies.

Table 3-3 CIRCTER case studies and the NUTS2 regions

CASE STUDY	NUTS 2 Code	Region
Scotland – circular economy strategy “Making Things Last”	UKM2	Eastern Scotland
	UKM3	South Western Scotland
	UKM5	North Eastern Scotland
	UKM6	Highlands and Islands
Maribor - The WCYCLE strategy	SI03	Vzhodna Slovenija
Brussels Regional Plan for a circular economy 2016-2020 (BRPCE)	BE10	Region de Bruxelles-Capitale
Basque Country circular economy initiatives	ES21	País Vasco
Sicily – Industrial symbiosis	ITG1	Sicilia
Central Germany – The Bioeconomy Cluster	DEE0	Sachsen-Anhalt

Table 3-4 Material flows in the CIRCTER Case Studies

	UKM2	UKM3	UKM5	UKM6	SI03	BE10	ES21	ITG1	DEE0
Material flows									
DMC per capita 2006 (tonnes/hab)	15.61	13.22	22.42	28.61	21.82	6.85	18	11.36	19.22
DMC per capita 2014 (tonnes/hab)	14.78	12.93	20.64	27.48	21.72	5.95	17.68	11.08	21.14
DMC intensity 2006 (kg/euro)	0.57	0.54	0.61	1.20	1.25	0.12	0.56	0.64	1.02
DMC intensity 2014 (kg/euro)	0.52	0.50	0.46	1.07	1.15	0.10	0.54	0.67	0.88
Biomass per capita 2006 (tonnes/hab)	2.83	2.91	3.66	4.20	3.04	1.83	2.33	2.83	3.35
Biomass per capita 2014 (tonnes/hab)	3.03	3.29	3.57	4.92	2.53	1.92	2.05	2.55	5.11
Biomass intensity 2006 (kg/euro)	0.10	0.12	0.10	0.18	0.17	0.03	0.07	0.16	0.18
Biomass intensity 2014 (kg/euro)	0.11	0.13	0.08	0.19	0.13	0.03	0.06	0.15	0.21
Metal ores per capita 2006 (tonnes/hab)	0.5	0.39	1.04	1.78	0.48	0.28	0.6	0.37	0.57
Metal ores per capita 2014 (tonnes/hab)	0.8	0.27	-	4.93	0.32	0.01	0.08	0.25	0.97
Metal ores intensity 2006 (kg/euro)	0.02	0.02	0.03	0.07	0.03	0	0.02	0.02	0.03
Metal ores intensity 2014 (kg/euro)	0.03	0.01	-	0.19	0.02	0	0	0.01	0.04
Construction per capita 2006 (tonnes/hab)	7.08	5.93	8.88	11.66	-	2.74	10.67	6.94	11.02
Construction per capita 2014 (tonnes/hab)	5.01	4.32	7.63	12.51	6.85	3.11	3.43	2.25	9.48
Construction intensity 2006 (kg/euro)	0.26	0.24	0.24	0.49	-	0.05	0.33	0.39	0.58
Construction intensity 2014 (kg/euro)	0.18	0.17	0.17	0.49	0.36	0.05	0.10	0.14	0.39
DE per capita 2006 (tonnes/hab)	15.78	10.90	31.83	64.84	22.07	-	11.25	9	20.41
DE per km2 2006 (tonnes/km2)	11.98	8.14	24.87	76.92	15.06	-	5.14	3.43	20.79
DE per capita 2014 (tonnes/hab)	1.67	1.85	2.20	0.69	1.93	-	3.31	1.74	2.47
DE per km2 2014 (tonnes/km2)	1.34	1.42	1.86	0.86	1.33	-	1.53	0.68	2.28

Table 3-5 Waste in the CIRCTER Case Studies

WASTE STREAMS AND WASTE BY NACE ACTIVITY	UKM2	UKM3	UKM5	UKM6	SI03	BE10	ES21	ITG1	DEE0
Waste generation									
Total waste generated per capita 2006 (kg/hab)	2,546.94	3,168.04	9,274.59	2,478.19	1,934.73	4,283.21	2,474.45	1,146.46	1,468.10
Total waste generated per capita 2014 (kg/hab)	1,585.49	1,588.83	600.74	1,482.73	1,386.45	2,622.82	1,830.79	1,256.02	1,805.49
Total households waste per capita 2006 (kg/hab)	697.53	690.73	650.66	720.24	-	479.74	562.31	559.90	411.95
Total households waste per capita 2014 (kg/hab)	573.49	550.34	516.03	603.13	250.99	445.33	435.67	480.45	453.46
Total foodwaste per capita 2006 (kg/hab)	350.87	380.99	291.29	251.62	145.52	656.83	322.37	249.61	181.14
Total foodwaste per capita 2014 (kg/hab)	204.88	241.26	165.68	100.93	93.71	803.09	369.71	111.05	147.07
Total WEEE per capita 2006 (kg/hab)	8.24	7.99	16.13	9.20	3.44	9.37	10.82	3.42	5.53
Total WEEE per capita 2014 (kg/hab)	9.55	8.05	12.11	7.14	3.95	10.43	4.22	3.36	7.97
Plastic waste per capita 2006 (kg/hab)	56.60	62.91	24.26	12.8	22.21	71.24	22.90	14.13	10.75
Plastic waste per capita 2014 (kg/hab)	32.11	32.12	11.26	8.46	30.35	157.35	14.47	31.60	20.83
Waste by NACE activity									
Agricultural waste intensity 2006 (kg/Tsd. Euro) (*)	57.20	39.34	39.19	45.98	499.90	0.58	79.25	36.42	79.25
Agricultural waste intensity 2014 (kg/Tsd. Euro) (*)	60.82	30.75	18.24	79.42	75	3.85	29.95	18.18	29.95
Construction waste intensity 2006 kg/Tsd. Euro) (*)	930.60	1,052.49	185.74	191.58	361.16	400.71	154.21	516.26	154.21
Construction waste intensity 2014 (kg/Tsd. Euro) (*)	944.05	1,126.65	225.52	328.30	320.76	570.86	199.67	449.19	199.67
Manufacturing waste intensity 2006 (kg/Tsd. Euro) (*)	126.09	172.22	119.06	42.60	332.51	132.14	102.47	44.13	102.47
Manufacturing waste intensity 2014 (kg/Tsd Euro) (*)	45.11	46.73	33.34	19.82	265.75	111.43	75.74	39.63	75.74
Mining waste per km2 2006 (tonnes/km2 - Waste by mining/total surface)	29.74	56.20	2,819.71	8.88	2.10	15.47	8.90	3.16	8.90
Mining waste per km2 2014 (tonnes/km2 - Waste by mining/total surface)	26.72	21.74	2,538.27	18.94	0.46	7.46	12.87	4.53	12.87

(*) Waste intensity: [Waste by agriculture/construction/manufacturing - kg] / [GVA by agriculture/construction/manufacturing- Tsd euro]

Table 3-6 Provision of materials, technologies and services for a circular economy in the CIRCTER case studies

	UKM2	UKM3	UKM5	UKM6	SI03	BE10	ES21	ITG1	DEE0
Material providers									
Number of Persons Employed per 1,000 Persons Employed in the Total Economy in 2010	14.71	13.78	11.12	40.34	51.65	5.51	18.13	38.36	19.85
Number of Persons Employed per 1,000 Persons Employed in the Total Economy in 2015	16.28	17.66	11.25	39.78	105.28	4.95	19.22	36.93	21.18
Growth Rate of Number of Persons Employed per 1,000 Persons Employed in the Total Economy in % (2010-2015)	0.10	0.28	0.01	-0.01	-0.03	-0.10	0.06	-0.04	0.07
Turnover per Material Provider Employee in 2010 (Thousand euro/employee)	164.74	187.46	129.76	103.06	53.51	591.04	171.98	142.82	284.22
Turnover per Material Provider Employee in 2015 (Thousand euro/employee)	210.73	240.99	172.26	139.47	75.31	629.15	196.31	158.49	319.11
Growth Rate of Turnover in thous. Euro per Material Provider Employee in % (2010-2015)	0.28	0.28	0.33	0.35	0.41	0.06	0.14	0.11	0.12
Technology providers									
Number of Technology Provider Persons Employed per 1,000 Persons Employed in the Total Economy in 2010	15.13	14.69	27.04	9.71	-	12.9	23.77	18.19	22.56
Number of Technology Provider Persons Employed per 1,000 Persons Employed in the Total Economy in 2015	18.58	14.34	34.21	10.98	19.4	13.16	24.25	17.02	21.3
Growth Rate of Number of Persons Employed per 1,000 Persons Employed in the Total Economy in % (2010-2015)	0.23	-0.02	0.26	0.13	-	0.02	0.02	-0.06	-0.05
Turnover per Technology Provider Employee in 2010 (Thousand euro/employee)	143.47	140.23	140.34	138.44	-	184.07	108.6	111.97	153.17
Turnover per Technology Provider Employee in 2015 (Thousand euro/employee)	193.96	196.18	202.96	188.92	79.54	217.92	110.94	116.17	171.09
Technology Providers Growth Rate of Turnover in thous. Euro per Technology Provider Employee in % (2010-2015)	0.35	0.40	0.45	0.36	-	0.18	0.02	0.04	0.12
Circular Business Models (CBM)									
Number of CBM Persons Employed per 1,000 Persons Employed in the Total Economy in 2015	30.85	3.87	1.68	1.86	0.39	5.76	16.12	0.13	3.67
CBM Turnover per Circular Business Models employee in 2015 (Thousand euro/employee)	87.06	461.56	296.42	294.1	323.69	157.27	161.6	98.69	147.07

3.3 Key achievements

Achievements of the six cases described in Table 3-7 depend very much on the starting date as well as the type of monitoring mechanisms in place, and vary depending on the scope and goals of the initiatives. While the initiative in Scotland (the one with the longer trajectory) has already been proved to be effective, and the first calls for projects in the Basque Country have had positive outcomes, the results of the first reporting and assessments in Maribor and Brussels are not ready yet. Some of the most significant initiatives in Maribor are not still in place, and the first reporting of the strategy that started in 2016 in Brussels will be conducted at the end of 2018.

The types of results depend very much on the types of initiatives and the actions implemented in each case. A strategy to transform the country/region/city is at the forefront of four of the six initiatives (Scotland, Maribor, Brussels and Basque Country), while the initiative in Sicily is an industrial symbiosis project, and the one in Central Germany is about fostering the regional bio economy through a cluster. In the case of Scotland, a new method to analyse and measure waste reductions carbon accounting approach and the Charter for Household Recycling are some of the main initiatives in place, and they are providing very valuable information to measure progress and decide policy action. In the Basque Country, the circular economy monitoring framework has allowed comparing regional performance in some indicators against the EU and national averages¹, and the first calls for projects have shown interesting results. In Germany and Sicily, matches, networking activities or joined projects gain importance when measuring the achievements. Table 3-7 shows the main achievements of the selected cases.

Table 3-7 Key achievements of the selected cases

Scotland – circular economy strategy “Making Things Last”

Scotland’s overall carbon impact has been reduced by 26% since 2011: Due to a decline in landfilling (the lowest rate recorded in 2016, despite still amounting to 32.5%) and improved recycling rates (particularly for high impact waste materials, like Construction and Demolition waste).

The Charter for Household Recycling is gaining momentum and was signed by half of all Scottish councils by July 2016.

The recycling rate of non-household materials has increased 26% between 2011 and 2016.

The Circular Economy Investment Fund have opened-up new revenue streams to companies.

Maribor - The WCYCLE strategy

Change in the management of the public utility companies.

The first quantitative results will be seen at the end of 2019: The objective is to increase the recycling rate in about 30%, and to increase the share of reusable waste from the current 14% to 44%. Economic benefits are also expected thanks to the future local market for secondary raw materials.

¹ Latest available data is 2015. Progress and trends will be observed when more recent data are made available

Brussels Regional Plan for a circular economy (BRPCE)

Innovative governance: Under a strong coordination structure, it leverages both offer and demand for circularity (111 actions that provide a holistic and transversal approach). A mix of bottom-up and top-down measures, which provide both the necessary amount of political direction, and the flexibility of involving a wide array of territorial actors.

Reporting on progress and potential revisions will be formally organized within the RPcircular economy every year and a half. 2018 is the first year that this reporting is going to be conducted. Therefore, there are no indication of results to date.

Basque Country circular economy initiatives

The main Basque industries are adopting circular strategies and trust on circular economy as a competitiveness factor is increasing: 59% of the Basque companies that eco-design considered in 2014 that eco-design is fundamental to differentiate in international markets.

The 87 companies that have participated to the “circular economy Demonstration Projects Programme” expect additional 38.7 million euro (because of new solutions)

Sicily – Industrial symbiosis

More than 690 potential matches were found between the participating enterprises. More than 80 SMEs were matched for potential collaborations to reuse waste.

The online platform is still being used (despite the end of the ENEA project in 2015).

Replication of the project in other regions

Central Germany – The Bioeconomy Cluster

In 2012 the cluster was one of the winners of the Leading-Edge Cluster Competition held by the Federal Ministry of Education and Research (BMBF)

Between 2012 and 2017 the Bioeconomy Cluster was accompanied by scientific research aimed at developing and implementing sustainable competitive action plans and management tools for the Bioeconomy Cluster

The cluster is able to identify complete value chains and has developed a strong research and development knowledge base and know-how in multiple areas (e.g. chemical industry and wood sector).

Around 500 to 600 jobs have been created with a potential for at least 5,000 new jobs in the entire region if a complete circular bio economy is developed (including all service personnel, etc.).

3.4 Enabling and hindering factors

Factors related to **agglomeration, governance, education and awareness, knowledge and technology** and **support to sustainable production and consumption patterns** can either enable or hinder the shift to a CE. The following conclusions are derived from the assessment of the enabling and hindering factors in the six cases:

- Agglomeration factors (both urban and industrial) are fundamental in the initiatives that take place at smaller geographical scales, such as the Wcycle strategy in Maribor, the RPeconomy in Brussels, the circular economy initiatives in the Basque Country and the Industrial symbiosis project in Sicily.
- Political vision and the importance of engaging a wide array of actors, including the academic sector, are key governance factors stressed in all the case studies. The RPeconomy strategy in Brussels offers interesting insights on how to successfully engage multiple actors and how to overcome silo policy-making.
- The existence of previous studies such as urban metabolism study in Brussels, the circular economy diagnosis in the Basque Country, the new method to analyse and measure waste reductions in Scotland or the background assessment (of local industries, related material flows and waste generation and costs) in Sicily provide a good evidence base to shape and implement adequate measures.
- Technology does not seem to be the main issue in the shift to a CE. This confirms the conclusions of previous studies, and point to other factors related to bringing technologies into the market, awareness raising about the opportunities offered by the circular economy among the involved parties, or education and skills as some of the most significant cornerstones to drive a circular economy. Similarly, adequate legislations and incentives play a meaningful role in transforming production and consumption patterns.

Table 3-8, Table 3-9, Table 3-10, Table 3-11, Table 3-12, and Table 3-13 summarise the enabling and hindering factors for all the six cases.

Table 3-8 Enablers and barriers of Scotland circular economy strategy “Making things last”

ENABLERS	HINDERS
Agglomeration	
NA	NA
Governance	
<u>Cooperation</u> between the government, its delivery partners and industry leaders <u>Common approaches</u> such as the Scottish Household Recycling Charter <u>Targeted funds</u> , including ESIF funds	NA
Education and awareness	
<u>Consultation process</u> to sensitise society <u>Collaboration</u> with delivery partners helped to understand the opportunities of the circular economy, and incentivised firms to seek out new collaborations and offer innovative types of products and services <u>Accurate information</u> about the circular economy development <u>Transformation of the educational system</u> in place A manufacturing skills academy The Curriculum for Excellence and lifelong learning	<u>Unawareness of commercial opportunities and perceived risks</u> may discourage businesses to innovate <u>Mainstream product design</u> does not favour sufficiently a CE <u>New ways of thinking value chains</u> are not yet strong enough
Knowledge and technology	
NA	NA
Support to sustainable production and consumption	
<u>Circular Economy Investment Fund</u> , which grants funding to SMEs for circular economy related innovations in products and systems across all sectors	<u>Absence of fiscal incentives and directives</u> promoting recycling over re-use <u>Not sufficient support to business leaders</u>

Table 3-9 Enablers and barriers of the “Maribor - The WCYCLE strategy”

ENABLERS	HINDERS
Agglomeration	
<u>Proximity with stakeholders</u> , facilitating the circulation of resources and flows, as well as contacts with innovators and users of these resources	NA
Governance	
Maribor's <u>Mayor's ambitious vision</u> of the future at Maribor <u>Positive attitude and work of public companies</u> in charge of the utilities to facilitate the creation of synergies and local symbiosis in the urban area	Difficulties to involve the <u>academic sector</u> <u>Political support in risk</u> due to the elections
Education and awareness	
<u>Successful awareness raising</u> among <u>public utility companies</u> <u>Residents' opposition</u> to incineration and landfill <u>High competences</u> of Mayor's advisers and of some innovative civil servants	<u>Not sufficient awareness</u> of the <u>consumers</u> and of the <u>private companies</u> of the advantages of the circular economy. <u>Not sufficient financial commitment</u> of the private sector
Knowledge and technology	
NA	<u>Limited knowledge on circular economy</u> (due to the difficulties to involve the academic sector in the process)
Support to sustainable production and consumption	
NA	<u>No specific regulations and financial measures</u> have been developed at the level of the Municipality <u>Regulatory constraints</u> decided at the European and National levels

Table 3-10 Enablers and barriers of “Brussels Regional Plan for a circular economy (BRPCE)”

ENABLERS	HINDERS
Agglomeration	
<p><u>Place-based economy</u>: 10 priority zones and the canal territory</p> <p><u>Relational proximity</u> offers critical mass</p>	NA
Governance	
<p><u>Clear political vision</u></p> <p><u>Innovative coordination</u> mechanisms to avoid silo politics: All administrations have the formal obligations to cooperate in implementing the circular economy strategy and finding synergetic actions</p> <p><u>Stakeholder engagement and multi-stakeholder collaboration</u> in the design and implementation of the RPlcircular economy (e.g. through Sustainable Neighborhood contracts)</p>	<p><u>Loss of skills related to inter-administration project management</u>. The operational coordination of the RPlcircular economy has indeed been contracted out to an external organisation. This means that the skills obtained in the management of such multipartite project will not be retained internally</p> <p><u>Not deep-enough reflection on the potential use of European funding</u> (outside the Research and innovation field)</p>
Education and awareness	
The <u>urban metabolism study as a starting point</u> : evidence to establish relevant concrete actions	NA
Knowledge and technology	
NA	<p>Not enough knowledge on the <u>creation of circular public markets from a legal and animation</u> point of view</p> <p>Not sufficient knowledge about <u>how to implement a territorial strategy linked to planning</u> which create favourable conditions for the circular economy to flourish</p> <p>Brussels does not have the infrastructure and therefore cannot currently valorise (i.e. reuse, refurbish, recycle) the entirety of outgoing flows.</p>
Support to sustainable production and consumption	
NA	NA

Table 3-11 Enablers and barriers of “Basque Country circular economy initiatives”

ENABLERS	HINDERS
Agglomeration	
Basque Country is <u>one of the main industrial hotspots in Spain</u>	NA
Governance	
<u>Significant competences in the environmental protection field</u> <u>Political vision and leadership</u> <u>Strong public-private partnerships</u> <u>Good combination of demand-pull measures with others aimed at pushing the supply side</u>	NA
Education and awareness	
<u>circular economy assessment</u> conducted in 2018 will drive the upcoming circular economy strategy	Companies are still <u>not fully aware</u> of the changes that are happening on their markets and have insufficient knowledge about the benefits that shifting to a circular economy can bring to them.
Knowledge and technology	
<u>Expert know-how of the STI system</u>	<u>Knowledge about the technologies and methods that can close the material and energy loops is not sufficient</u> . Likewise, technical uncertainties about lifecycle behaviour, adaptation to new legislation or lack of finance challenge the delivery of innovative solutions into the market.
Support to sustainable production and consumption	
The first projects (e.g. Demonstration projects call) are delivering good results	NA

Table 3-12 Enablers and barriers of “Sicily – Industrial symbiosis”

ENABLERS	HINDERS
Agglomeration	
<u>Local industries, related material flows, waste generation and costs</u> were considered from the very beginning of the project and drove the matchmaking exercise	NA
Governance	
<u>Collaborative environment increased trust:</u> Workshops and working through local organisations. Openly discuss responsibilities, predictability of outcomes and the reliability of the assessment	NA
Education and awareness	
<u>Good comprehension of the potential for companies:</u> Once they understood that there was a potential to reduce costs and the administrative (procedural) burden for their production activities, they showed stronger commitment to facilitate the realization of the matchmaking.	NA
Knowledge and technology	
<u>Availability of a transparent online platform</u> that everyone could use supported the transition from a climate of distrust and scepticism to one of collaboration and symbiosis.	NA
Support to sustainable production and consumption	
NA	<p>There are policies and regulations that are difficult to understand and do not facilitate the reuse of waste</p> <p>The existing legislation, and the considerable requirements (or burden) emerging when a material is classified as waste as opposed to a resource (or input to production).</p>

Table 3-13 Enablers and barriers of “Central Germany – The Bioeconomy Cluster”

ENABLERS	HINDERS
Agglomeration (incl. agglomeration of naturel sources)	
<p><u>Strong chemical industry</u> <u>Availability of beech-stock</u> (around 40% of the German beech stock)</p>	
Governance	
	<p><u>Strategic policy measures are not sufficiently developed</u> to drive a circular bio economy transition: stable long-term framework (for the development of wood-based products, renewable alternatives for plastic bags and cups, etc.), policy-makers as a pioneer in using bio-based products</p>
Education and awareness	
<p><u>Well qualified workforce</u></p>	<p>The region has <u>difficulties attracting or retaining new skilled workers</u>. <u>Not sufficient awareness of opportunities</u> related to the circular bio economy</p>
Knowledge and technology	
<p><u>High-performance research and development</u> at regional level <u>Essential role of the cluster in building knowledge</u>: Provides information to firms, acts as a platform/network (cascade utilisations of waste -symbiosis)</p>	<p><u>Not sufficient funding for R&D</u></p>
Support to sustainable production and consumption	
<p><u>The cluster plays a key role in supporting and promoting innovation</u></p>	<p><u>Homogeneity between the partners</u> in the Cluster (beech wood-based processes limits strategic innovation processes) <u>Missing investments</u> in bio-based innovations <u>Few start-up activities</u> <u>Lack of policy incentives</u> to implement a circular bio economy (e.g. large chemical companies are missing incentives to invest in innovation to replace crude oil as a basic product; consistent pricing policy)</p>

3.5 The way ahead

Table 3-14 describes the capacities of the different territories assessed in the case studies to keep unlocking the potential for a CE.

Table 3-14 Capacities to keep unlocking the potential for a CE

Scotland – circular economy strategy “Making Things Last”

The country’s potential to unlock further circular economy opportunities is important, as long as a sustained investment and interest by all actors is secured. For a sustained public and business support towards a Circular Economy, it is necessary to provide continuous support in order to increase business and consumer awareness and involvement. Confidence in remanufactured products needs to be assured and fiscal incentives continued to assure a sustainable circular economy.

Through the inauguration of the £65 million National Manufacturing Institute for Scotland, in collaboration between the University of Strathclyde as its anchor, the Renfrewshire Council and the Lightweight Manufacturing Centre, the aim is to establish an industry-led international centre for manufacturing expertise. The Centre will benefit from international industry expertise and cutting-edge research and will thus help to promote innovations for all manufacturing businesses throughout Scotland. It will also offer rewarding careers for young people and boost Scotland’s manufacturing and engineering sectors.

Maribor - The WCYCLE strategy

The circular economy opportunities are perceived as huge. The main idea is to close the loop locally. Maribor can reuse most of the resources thanks to utility agencies. For example, 80% of the construction materials could be reused and recycled. The bio-waste has also a high potential. Projects will be used to upgrade/upscale pilots to manage the bio-waste of the city and to analyse the costs, the return on investment, costs to implement a final and innovative solution for the bio-waste of Maribor.

The city of Maribor attempt to create a functional area of the city for which 2 out of 20 municipalities have already given their agreement due to the business opportunities for their own stakeholders.

The Snaga automatic new and high-tech waste management plant has still to demonstrate its efficiency.

The engagement of the private companies and the collaboration with the associations in the field of circular economy are two other challenges.

Brussels Regional Plan for a circular economy (BRPCE)

The territory of Brussels should become more circular as a consequence of the RPCE. The 2015 metabolism study has identified some of the territorial characteristics which could be levered to improve the circularity of the region, related for instance to the resources endowment of the region and the identification of activities which could help retain more value and extend the life of these resource within the territory. It takes a holistic approach to leveraging this circularity, integrating actions on circularity demand and offer, and the creation of positive framework conditions (e.g. creation of circular skills and jobs, removing of legal barriers, etc.). These activities are expected to shape the Brussels territory by densifying function areas (i.e. of industrial and economic activity) where interlinkages between stakeholders are increased.

Basque Country circular economy initiatives

The implementation of the circular economy in the Basque industry is expected to decrease 6% the raw material consumption and consequently saving 2,000 million euro. The metal (steel, foundry, metal-products) and transport (automotive, aeronautics) industries, with 49% of total savings, would be the main beneficiaries. Besides, Basque companies expect increasing 46% the green product sales by 2025.

According to a 2017 survey to 41 companies to whom eco-design offers strategic value, the eco-design products will almost mean half of their total turnover in 2020. Moreover, 33 companies show high potential to initiate remanufacturing companies (in addition to the current 42). Remanufacturing rate could increase from the current 2.1% to 3,6% in 2020 and 5.6% in 2025.

Sicily – Industrial symbiosis

This project was conceived before the circular economy concept became known/mainstream locally (in Sicily) and the goal of the project was to develop and test a platform that could raise awareness about the opportunities emerging from the use of Industrial Symbiosis.

Having shown how to unlock the potential of Industrial Symbiosis, ENEA sees opportunities for this project and work to grow further in Sicily. This is in the context of expanding the collaboration between companies (i.e. realizing a larger portion of the matches identified) as well as to expanding the analysis to more sectors.

Central Germany – The Bioeconomy Cluster

Through the unique linkage of the core industries of timber, chemicals and plastics, the region has great potential to establish and further expand a circular bio economy. The following three factors could form the basis for this transformation: Established chemical site, high availability of bio-based raw materials, high quality research in chemistry and bio economy.

4 Lessons learnt from case studies

Case studies confirmed that territorial factors condition the shift to a CE. Understanding those factors is the first step any territory needs to take. Likewise, replicability potential is bounded by those place-based factors. The materialisation of a circular economy requires an integrated and long-term system change that should be steered by policy-making and where education, awareness, networking and collaboration play a meaningful role.

4.1 Territorial factors matter

The case studies have confirmed that spatially-bound assets and features condition the way a circular economy is operationalised. These do not just include physical assets, capacities and installed technologies, but also soft and intangible features embedded in governance, cultural and social aspects. The latter are intrinsically localised and embodied in human capital and relational networks. Territorial factors that shape the capacity of territories to shift to a circular economy can be classified as nature-based aspects, agglomeration economies, accessibility conditions, knowledge- and technology-based enablers, as well as governance and institutional drivers.

Nature-based aspects (i.e. high availability of bio-based raw materials) are crucial to enable a circular bio economy (preserve and enhance natural capital through biological cycles) as the case study in Central Germany demonstrates. This region concentrates 40% of the German beech stock. However, beech wood is subject to long production times and a growing influx of timber from fast-growing plantations in other regions of the world could threaten local supply loops.

Agglomeration factors, both urban and industrial, are an important territorial enabler for the circular economy. On the one hand, the **industrial clusters** play a key role in unfolding innovation potentials. Basque Country is one of the main industrial hotspots in Spain and a strong industry orientation features the way circular economy is operationalised in this region. The shift to a circular bio economy in Central Germany is taking place around the well-established chemical site and the unique linkage of the core industries of timber, chemicals and plastics. Besides, the BioEconomy cluster is having a key role in building and fostering relationships and sharing know how crucial to innovation efforts toward a circular bio economy. In Scotland, targeted activities across sectors and Scottish cities are allowing to address the particularities of industries and communities alike. In Sicily, a network of local stakeholders and companies allowed for the identification of matches between companies that generate waste and those that can use it as a resource. On the other hand, **urban agglomerations** ensure the necessary 'critical mass' to e.g. adopt low-value waste management approaches, as well as to endorse a range of community-based initiatives around the circular economy. Brussels is pursuing a place-based economy (closing material loop on the territory) by building upon the relational proximity between the actors and by focusing on 10 priority zones and the canal territory. The initiative in Brussels (a frontrunner runner city in the implementation of a strategy aiming to transition to the circular economy) backs the assumption that cities seem to be the right context to promote function-based business models, given that in the European context cities concentrate the larger share of young, prone-to-change populations.

Accessibility conditions also matter to implement a circular economy. The platform to facilitate industrial symbiosis in Sicily assesses proximity (location and transport costs) to identify opportunities for matching (collaboration to reuse waste). Strong ties to Eastern Europe and

interlinkages with national and international initiatives to promote a bio economy are meaningful assets in the shift to a bio economy in Central Germany.

Knowledge and technology-based enablers: Strong knowledge and technology basis are highlighted as a meaningful driver by all the case studies. This embodies not only the scientific and technological knowledge, infrastructures and networks (e.g. the access to leading research institutions with laboratory, pilot and demonstration facilities located in Saxony-Anhalt, and high potential of skilled workers through universities and vocational training form the basis for establishing a circular bio economy in Central Germany), but also other factors such as building a strong evidence base before strategic decisions are made (urban metabolism study in Brussels, the circular economy diagnosis in the Basque Country, or the new method to analyse and measure waste reductions in Scotland).

Policy plays a substantial role in establishing and leveraging the knowledge and technology basis. The Circular Investment Fund in Scotland, the grants for cooperation projects among research actors and practitioners in Brussels or the Circular Economy Demonstration projects in the Basque Country are bringing innovations into the market. Similarly, the Scottish authorities put a distinct focus on skills and education for a Circular Economy. Reshaping the economy and its processes and consumption models requires to identify new, specific skills which will be needed to enable the different approaches in product design, resource handling and communication. This will allow to increase the trust in remanufactured goods and secondary raw materials along the value chain and consumers. As new opportunities arise, it will be important to promote and support the reskilling of the existing workforce, to allow the labour force to adapt adequately.

Governance and institutional drivers: All the case studies point to governance and institutional factors such as clear political vision, engaging a wide array of actors, public-private partnerships, stable long-term framework and targeted actions, monitoring mechanisms, etc. to explain their success so far, or as a fundamental driver for the way ahead. The success of the BRPcircular economy in Brussels lies in the innovative governance, which sought the implementation of a strong coordination structure in order to avoid silo politics, and to ensure political buy in at an early stage. The leading role of public authorities in shaping a circular economy strategy and pushing it forward (through e.g. green public procurement, grants, fiscal deductions, etc.), the establishment of a monitoring framework and embedding the environmental sustainability in the overall regional strategy, are the main governance drivers in the case of the Basque Country. In the case of Scotland, the leading role of government to identify specific sector opportunities, raise awareness (through a successful public consultation) and implement common municipal approaches are being crucial to transition to a CE.

The CIRCTER case studies confirm that policy is called to play a great role in steering the transition to a CE. Sustained support for industry and society (fiscal incentives, access to funding, etc.), improving awareness on opportunities around the circular economy, transforming education, ensuring the creation of niche markets and a level playing field (through e.g. public

procurement, adequate legislations) for products manufactured according to circular economy parameters are some of the policies that may contribute to boost circular economy transitions.

Similarly, several of our case studies confirm the **meaningful role played by ESIF** in the shift to a CE. In the case of Scotland, by providing important amount of targeted funding, the ERDF has played a major role in the success for the strategy. Several programmes to support the shift to a circular economy in the Basque Country are partially funded by the ESIF.

4.2 Replication potential is bounded by territorial specificities

The relevant role played by territorial specificities whereby similar features act as enablers or barriers depending on the specific territorial context, challenges the **transferability and replication potential** of the cases. There is no “one-size-fits-all”, and understanding the territorial specificities, with their socio-economic, environmental and institutional realms, is crucial to envisage a successful transition to a circular economy. Therefore, a sound assessment of the above listed territorial factors is the first step that any territory should take to shape its own place-based circular economy strategy, alongside more technical assessments such as urban metabolism studies (as in Brussels), or other kind of diagnosis (the circular economy diagnosis in the Basque Country based on a set of indicators, or the new method to analyse and measure waste reductions in Scotland).

4.3 An all-encompassing transformation

The materialisation of a circular economy requires an integrated and long-term system change. All actors in the economic circuits are expected to adopt a prone-to-change attitude to re-organise around new ways of production, value creation, and consumption patterns. Direction setting, through right boundary conditions and a stimulating framework, is the main task attributed to public authorities at all levels; R&D organisations provide the relevant scientific and technological know-how; the industry produces responsibly and transforms the value creation system; and lifestyles are changed according to the circular economy principles. Policy-making must steer this long-term system change, where education and awareness play a meaningful role.

4.3.1 Policy must steer the transition

The case studies confirmed that adopting place-based policy approaches (that take account of the installed capacities within each territory) and promoting inclusive and participatory policy design and implementation processes are crucial to unlock the territorial potentials. Policy must play a great role in steering such a transition **and three key changes are needed** in the policy framework in this regard.

First, examination and adaptations are needed across the set of sector-oriented policies to promote circularity in a consistent way. The potential for implementing the circular economy may be **encouraged or limited by other policy imperatives**, embedded in the local context. Our case studies show that a number of policies and regulations may hurdle circularity transitions (e.g. higher requirements when a material is classified as waste as opposed to a resource or input to production). Similarly, vested interests in the status quo (e.g. the use of fossil fuels in industry and for energy) are to be overcome. This highlights the inherent iterative nature of planning for circularity and the importance of improving the coherence of the circular economy with these other priorities. To overcome these barriers, local agreements around shared goals and well-established monitoring mechanisms are needed. The creation of collaborative environments to openly discuss responsibilities (e.g. waste is recognised as a sub-product to avoid procedural burden) and build trust are equally important. Second, innovative products that follow circular economy principles must be promoted, e.g. by supporting research and development and the creation of niche markets (through public procurement, awareness raising, incentives, etc.). Finally, policy frameworks must provide a level playing field for products that follow the circular economy principles.

4.3.2 Knowledge, awareness and education matters

Awareness and education offer enormous potential to change business and consumer behaviour, and hence, transform the consumption and production patterns. The cases that achieved raising awareness and getting the commitment of all kind of actors, made a difference. However, the case studies have evidenced that there is much to do in this field. Companies are not sufficiently aware of the market changes that are hindering 'business as usual'. Business opportunities around the circular economy are not sufficiently known. Many companies still perceive the new circular business models as being particularly risky, and this perception discourages them to innovate. Consequently, mainstream product design does not favour sufficiently a circular economy, and new ways of thinking value chains are not yet strong enough.

Similarly, a sensitised society is essential. The success of e.g. high-durability products, remanufactured products, etc. ultimately depends on *consumer behaviour* in the marketplace. As the real benefits of awareness and education are unleashed in the longer run, they are normally accompanied by regulatory measures and market and fiscal incentives both for the consumers and the industry.

4.3.3 Networking, knowledge exchange and collaboration

Networking, knowledge exchange and cooperation help in multiple ways to drive a CE. First, and as it is intended by the case studies work in the CIRCTER project, assessing and disseminating the shift to a circular economy in specific territories can stimulate others to take their

own steps to progressively abandon the linear economy. The work done by the ACR+ to establish a Circular Europe Network² is very valuable in this regard. Second, disseminating experiences and initiatives bounded within a territory can encourage others in the same territory to explore the opportunities offered by the CE. This works for cities within a region/country that pioneer the transformation of the local economies and lifestyles, but also for companies that lead the way and inspire counterparts to do the same. Circular Basque³ is a network of organisations that are committed to transforming the currently predominant economic model, and that disseminates initiatives and experiences that demonstrate how it works in reality. Also in the Basque Country, IHOBE has published the results of the “circular economy Demonstration Projects Programme”, which is intended to increase the number of applicants in the upcoming calls. Third, and beyond knowledge exchange, collaboration within and among territories is essential. The way a circular economy works is more easily understood if we look at locally organised value creation systems (e.g. industrial symbiosis in an industrial park, biomass district heating, etc.). But the experience of the BioEconomy cluster in Central Germany shows how important establishing international collaboration can be. This cluster has joined forces with leading bio economy clusters in France, the Netherlands and the UK to form Europe’s Bioeconomy Intercluster (3BI), which was founded in 2015. It aims to help European companies make the most of new markets and new opportunities from the bio economy. Specifically, it intends to strengthen European collaboration and innovation to create globally competitive products and services for the bio economy as well as to help European companies working in this sector to access the international partnerships and overseas markets they need.

4.4 Incorporate and enhance monitoring

Monitoring and evaluation should play an important role in the governance of any Circular Economy strategy. It is of outmost importance to identify new areas of innovation and continue updating the CE strategy on an ongoing basis, as well as to assess the development at national and European scale. The Scottish Carbon Metric, which measures the whole-life carbon impacts of Scotland’s waste regardless of where in the world these impacts occur, allows policy makers and business leaders to identify and focus specifically on those waste materials with the highest carbon impacts and greatest potential carbon savings. This indicator should be considered in upcoming updates of the European Circular Economy Monitoring Framework should be explored.

² <http://www.circular-europe-network.eu/>

³ <http://www.circularbasque.eus/en/>

5 References

Brussels Regional Plan for a circular economy 2016-2020 (BRPCE) (2017a). Possible territorial futures. final report. vol. d: Circular economy. Technical report, ESPON

6 Templates used to collect information on CIRCTER Case studies

6.1 Data and information collection form

Name of the Territory and country:

General information about the region/city:

Administrative structure (region, municipality, etc.) and policy framework:

Type of territory - (1) urban-rural; (2) metropolitan regions; (3) border regions; (4) islands regions; (5) sparsely populated regions; (6) outermost regions; (7) mountainous regions; (8) coastal regions; (9) regions in industrial transition:

Description of the regional geography (e.g. natural assets) and economy (main sectors):

Population (the latest available data). In Eurostat: demo_r_pjangroup (NUTS2), demo_r_pjan-grp3 (NUTS3):

Surface: km²

GDP per capita (the latest available data).

In Eurostat:

- <http://ec.europa.eu/eurostat/cache/RCI/#?vis=nuts2.economy&lang=en> (for NUTS2 and NUTS3)
- [met_10r_3gdp](#) for cities

Share of people having attained tertiary education from 25 to 64-years old (the latest available data)

In Eurostat:

- <http://ec.europa.eu/eurostat/cache/RCI/#?vis=nuts2.education&lang=en> – Population aged 25-64 by educational attainment level, sex and NUTS2 region (%). Total, Tertiary education (levels 5-8)

Unemployment rate (the latest available data)

In Eurostat:

- <http://ec.europa.eu/eurostat/cache/RCI/#?vis=nuts2.labourmarket&lang=en> Unemployment rates by sex, age and NUTS2 regions (%). From 15-74 years. total

circular economy Statistics (*):

Material flow data:

Waste data:

Circular economy within the context of the Regional Innovation Strategy for Smart Specialisation (RIS3) - Linkage between the priority sectors and the circular economy (value chain aspects)

Potential of the region/city for Circular Economy/Circular economy opportunities

What do previous studies/reports say about the potential for circular economy and circular economy opportunities? Try to link to specific sectors and provide quantitative information – if this has been made available by the analysed studies/reports⁴

Main feature of the case study (multiple choice is possible:

- a) Regional strategy/mission orientation towards the CE
- b) Sustainable materials management
- c) Big front-running city / metro area
- d) circular economy business models
- e) Industrial symbiosis
- f) Bioeconomy
- g) Others

Case description:

Active since:

Brief description of the case study:

Drivers and other enabling conditions:

Targets and results/achievements (economic, social and environmental impact, findings of cost-benefits analysis if they do exist):

Stakeholders involved (type and name of the organisation) and governance structure/organisational framework:

⁴ See Table A in page 15 of https://www.ellenmacarthurfoundation.org/assets/downloads/20151113_DenmarkCaseStudy_FINALv02.pdf

Role played by the European Structural and Investment Funds (ESIF), as well as Horizon 2020 projects in the transition towards CE.

Main references related to the initiative (web links):

6.2 Interview guides

Interview guide – Person in charge of the initiative

Name of the interviewee:

Contact details (phone, email):

Is there anything you would like to add/comment on the ‘Data and information collection form’ (see the previous step and fill out the gaps)?

Please, explain why you decided to adopt a circular economy model

How has your region/city adapted/incorporated the European circular economy agenda to the regional/local circumstances?

How would you assess the potential of the region for Circular Economy? Identification of circular economy opportunities

Transitioning to a circular economy calls for shared responsibility and action. Is there genuine commitment at regional/local level to shift to a CE? Is the region/city equipped with the necessary institutional infrastructure to support the transition to the CE?

Describe the governance structure and organizational framework. **Description of organizations involved, their role and how they interact, interactions with other territorial levels.**

What is the role played by the European Structural and Investment Funds (ESIF), as well as Horizon 2020 projects in the transition towards CE?

What are the main drivers that are facilitating the transition of your region/city to a CE?

We would like to learn about the framework conditions that are enabling the shift towards a circular economy, and unlocking the economic, social and environmental opportunities associated to this model

ENABLING FRAMEWORK CONDITIONS	More details
Strategic planning in place for a transition to Circular Economy (strategies, action plans, RIS3)	

Increasing awareness and educating society to change lifestyles and consumption patterns (demonstrate the value of transitioning to a circular economy, reinforce trust in re-used and recycled products)	
Reinforcing upskilling of the workforce	
Creating a market for circular economy (public procurement, demand side incentives such as tax breaks and subsidies in order to make sure that it pays-off to be sustainable, regulatory measures such as circular economy labelling, etc.)	
Information and promotion (advisory, help desk, collaboration platform, training)	
Institutional (innovativeness of the institution, funding, administrative position, multi-stakeholder approach, etc.)	
Voluntary measures (green deals, labels, guarantees, etc.) related to circular economy + Online self-assessment tool	
Regulatory (regulations, bans, permits) related to CE	
Investment in enabling technologies	
Changing production patterns (e.g. eco-design, cheap loans to companies adopting sustainable production patterns, conditional public funding, reinforcement of closed-loops at regional/local level, increase trust on re-used materials, rule the Environmental Producer Responsibility, etc.)	
Reinforcement of innovative business models (regulation, research, incentives, etc.)	
Economic instruments (charges, taxes, fiscal)	
Financial support (subsidies, investments, funding)	
Others	

What are the main results achieved so far in the transition to a circular economy (try to provide as much quantitative information as possible – e.g. cost-benefit analysis, and try to assess the Economic, social and environmental impact:)?

What have been the main success factors?

What are the main barriers faced in transitioning towards a CE?

To which extent and how do the territorial conditions affect (either positively or negatively) your transition towards the CE?

How would you assess the cost-benefit relationship of shifting to a circular economy (very positive, positive, negative or very negative)? Explain why and accompany with figures, if possible

How would you assess the region/city's capacity to keep unlocking the potential of a circular economy (in terms of e.g. ambition and resources, research and innovation, policy landscape, access to finance, pool of skills, readiness level of companies and society, etc.)? (Very high, high, average, low, very low, and explain why)

Have you already agreed the next steps? Could you describe them?

CIRCTER project is developing a tool to gather the results of the analysis. Do you need a tool that highlights the key enabling conditions for a circular economy in different territorial contexts? If yes, which information/functionalities could be the most useful for you?

Interview guide – Other stakeholders

Name of the interviewee:

Contact details (phone, email):

What is your role in the initiative?

Transitioning to a circular economy calls for shared responsibility and action. Is there genuine commitment at regional/local level to shift to a CE?

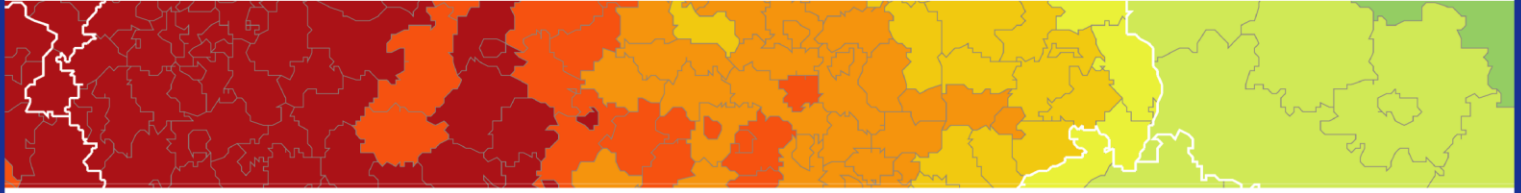
What are the main outcomes of you being involved in this (e.g. enable changing production patterns, access new markets, increased competitiveness, changing consumption patterns, etc.)?

What are the main barriers you faced (e.g. finance, skills, regulation, etc.)?

In your opinion, to which extent and how do the territorial conditions affect (either positively or negatively)?

How would you assess cost-benefit relationship of you participating in the initiative? (very positive, positive, negative or very negative)? Explain why

How would you assess the region/city's capacity to keep unlocking the potential of a circular economy (in terms of e.g. ambition and resources, research and innovation, policy landscape, access to finance, pool of skills, readiness level of companies and society, etc.)? (Very high, high, average, low, very low, and explain why)



ESPON 2020 – More information

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