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CircE - European regions toward Circular Economy"

INTERREG Europe Project

Synoptic report

Opportunities, Barriers and Value Chain analyses

Annex 2: Barriers

13 august 2018

Analysis of the Barriers to the development of Circular Economy

Contents

Definitions

Business as usual	Normal execution of operations within an organization. In this questionnaire we refer to 'business as usual' to businesses that follow the linear approach.
Externality	Cost or benefit that affects a party who did not choose to incur that cost or benefit. Unregulated markets in goods or services with significant externalities generate prices that do not reflect the full social cost or benefit of their transactions; such markets are therefore inefficient.
Infrastructure	Fundamental physical and organizational structures and facilities, such as transportation, communication, water and energy supplies, waste and water treatment facilities, on-line platforms or apps.
Policy tools	Includes different options: information & awareness (public communication campaigns, oriented education programs...), collaboration platforms (public-private partnerships, R&D programmes...), business support schemes, public procurement & infrastructure, regulatory frameworks and fiscal frameworks, etc.
SME	According to the European Commission, Small and Medium Enterprises are enterprises that follow this definition: *Company category* *Employees* *Turnover* *Balance sheet total* Medium-sized < 250 ≤ €50 million ≤ €43 million Small < 50 ≤ €10 million ≤ €10 million Micro < 10 ≤ €2 million ≤ €2 million Any company beyond these specifications is a **Big company**.
Split Incentive	A circumstance in which the flow of investments and benefits are not properly rationed among the parties to a transaction, impairing investment decisions.
Transparency	Sharing information and data on processes, flows and products regarding CE within all the actors of the value chain
Value chain	In a circular economy the value chain includes both, 'classic' suppliers (new products and services) and 'circular' suppliers (recycling, recovery, maintenance and remanufacturing actors) that are critical to ensure a circular performance.

1. Rationale

In order to move forward in the development of a Circular Economy, it is important to understand those aspects (social, economic, regulatory, etc) that may impair it. This report presents the results of the assessment performed by the project partners of the CircE project on the **main barriers to the development of Circular Economy (CE) in relevant sectors of the different EU regions participating in the project.**

Previous studies on the development of a CE identified a wide variety of aspects that could, somehow, hinder a complete and vast implementation of a CE. We grouped and classified these aspects into six categories called Barrier groups that we analysed thoroughly throughout specific questions.

The Barrier groups taken into account for this study were:

- Economic- financial aspects.
- Regulatory failures- legislation and government support.
- Social factors- social acceptance and attitudes.
- Market failures- aspects that the current market has not been able to regulate.
- Business structure- businesses organization and governance issues.
- Technology - access to technology and demand for new skills.

We believe that addressing all these barrier groups will bring a holistic approach to the subject, thus giving a founded vision of the state of CE inclusion in Europe.

2. Methodology of Analysis

This study is based on the analysis of the responses to a structured questionnaire (see Annex 1) about the existing barriers for the transition towards Circular Economy (CE) provided by CIRCE project partners. Data is segregated according to region, specific sector and business type (SMEs and Big Corporations).

2.1. Questionnaire structure and partner approaches

The questionnaire classified potential barriers into six categories (Barrier groups) according to the current literature on circular economy. To analyse the barrier groups broadly, each of them was divided in two or three subtype barriers as shown in Table 1.

Barrier group	Barrier subtype	Definition
ECONOMIC		Financial barriers can relate to:
	Profit	- capacity to generate revenues from introducing CE strategies
	Capital	- access to money
	Costs	- additional costs
REGULATORY FAILURES		Regulatory barriers can relate to:
	Regulatory frameworks	- legal frameworks to support the transition to a CE that are not yet in place at regional, national or European policy levels
	Government support	- the support received from institutions to lead such transition, as well as unexpected consequences due to incoherencies and contradictions within the current legal frameworks or regulations
SOCIAL FACTORS		The level of acceptance of green products and services and the attitudes towards it, both from society and businesses can relate to:
	Internal business culture	- attitudes and mental frames at management and operational levels
	Customers and society	- social attitudes and behaviours
MARKET FAILURES		Aspects that the current market has not been able to regulate can relate to:
	Externalities	- non-inclusion of indirect environmental and social costs to the final price of products and services
	Competition	- competition in a linear economic and productive system
	Business ecosystem	- the existence of a network of green businesses that can supply market demands
BUSINESS		The internal structure of current businesses can relate to:
	Governance	- how directions and instructions are shared and given within companies - how information is shared within and among companies
	Additional costs	- administrative work originated from inclusion of CE strategies
TECHNOLOGY & KNOWLEDGE		Access to technology can relate to:
	Accessibility	- difficulties to implement and/or develop new technology
	Skills	- knowledge of CE and sustainability at a technical and employees level

Table 1: Classification of potential barriers

The questionnaire (see Annex 1) was structured in two different parts:

- **Quick overview (Q 1 to 20)** - this part wanted to identify: i) barriers' subtypes that are critical to the development of a CE (very important); ii) barriers' subtypes that affect the development of a CE but are not critical (important); and iii) barriers' subtypes that do not affect the development of a CE (not relevant).
- **Questions (Q 21 to 98)** – this part goes deeper in understanding the particularities of each barrier group and the instruments that could be applied to overcome them. Some questions were clarified qualitatively with open responses.

Project partners adopted different approaches for answering the questionnaires which are explained in the *Snynoptic Report on the Barriers Questionnaire* and summarized as follows.

Lombardy

The survey included representatives from almost all sectors being examined by the project. The questionnaire was shared with stakeholders. Half-day meetings (one per SH) were scheduled to explain and complete the questionnaire.

Sector	# of SH consulted	Organisations
Biomass - wood	1	1 association
WEEE	2	Centro di Coordinamento RAEE 1 company
Food Waste	2	1 Non-profit organization 1 company
Plastic	1	1 National Consortium
Built Environment	5	ANCE Lombardia 4 companies.
Textile	6	one meeting, with the support of CENTROCOT
Cross-cutting	4	1 non-profit organization 3 Clusters

Gelderland

Gelderland stakeholders are representatives of their industry. Although there are only three questionnaires completed, the answers represent the state of the art in the three target sectors in Gelderland. However, SH felt that there could have been more time to discuss and validate the input of the questionnaire within each sector.

Sector	# of SH consulted	Organisations
Biomass- paper sector	1	University
Textile	1	company
Build Environment	1	company

Lower Silesia

Information to complete the questionnaire was gathered at the project Stakeholders meeting, via e-mail, and through the CE Polish group on Facebook (Institute CE). Low feedback on the questionnaire from stakeholders and companies was received and some questions were perceived as confusing.

Sector	# of SH consulted	Organisations
Raw materials	9	2 companies 4 Public agency 2 expert 1 University
Biomass	5	1 University 1 expert 3 Public agency
Food waste	5	1 expert 1 University 3 Public agency

Sofia

The questionnaire was distributed via emails and by post. A stakeholder's workshop, expert meetings and standardized interviews were also held. Sofia municipality managed to gather the representatives from recovery organizations (for packaging waste and WEEE), a recovery and recycling company of WEEE, the Built Sector Association and a recovery company, academic institutions and consultancies. The results from 19 completed and submitted questionnaires were summarized in a report.

Sector	# of SH consulted	Organisations
Built environment	1	Municipal enterprise
Food waste	1	Municipal enterprise
WEEE	1	Company
Raw materials	1	Company
Non specific	15	Academy, institutions and other

London (LWARB)

The questionnaire was sent to several stakeholders, but not all of them responded. Those that responded are:

Sector	# of SH consulted	Organisations
Built Environment	5	1 Association of Sustainable Building Products 1 Research 2 Company 1 Public authority
Textiles	2	1 Textile recycling association 1 consultancy
Food	2	1 charity 1 Public body

Information on barriers to the circular economy in London was also gathered in the first semester during focus groups on each of the five selected sectors, and during meetings and workshops with organisations and businesses. These included: Large multi-national retailers, Development Corporations, Public sector organisations, Built Environment large companies, Built Environment SME, Research and membership groups, Academic Institutions, Large consultancies, Small consultancies, Charities, not for profit, and foundations.

Catalonia

A CE consultancy undertook an analysis of the textile and beverage sectors in Catalonia which was coordinated by the policy officers in charge of CircE. Consultants gathered some information on CE barriers through individual interviews to different SH. This information, together with the information gathered through the different SH meetings carried out, was the basis to answer the questionnaire.

Sector	# of SH consulted	Organisations
Textile	11	2 clusters 2 research centres 6 companies 1 Public agency
Beverage	12	1 cluster 9 companies 1 research centre 1 Public agency

Slovenia (SOS)

Questionnaires were sent via e-mail to official stakeholder groups. Stakeholders that answered the questionnaire were mostly from public sector, working in tourism, built environment, waste management and food (production). Few stakeholder meetings were also conducted with waste, food and tourism sectors to discuss about the results of the questionnaire, opportunities and barriers of CE and to gather further information.

Hauts-de-France

Cd2e presented 2 questionnaires (1 for plastics and 1 for the textile sector).

2.2. Overview of answers received

Answers were given by region and sector (see Table 2), and all of them differentiated between Small and Medium Enterprises (SMEs) and Big Corporations (BCs).

SECTOR	LOMBAR-DIA	GELDER-LAND	LOWER SILESIA	SOFIA	LWARB[1]	CATALO-NIA	CD2E	SOS
BIOMASS	SMEs & BCs	SMEs & BCs	SMEs & BCs					
BUILT ENVIRONMENT	SMEs & BCs	SMEs & BCs		Municipal enterprise	SMEs & BCs			
PLASTICS	SMEs				SMEs & BCs		SMEs & BCs	
FOOD WASTE	SMEs & BCs		SMEs & BCs	Municipal enterprise	SMEs & BCs	SMEs & BCs (beverage)		
TEXTILE	SMEs	SMEs & BCs			SMEs & BCs	SMEs & BCs	SMEs & BCs	
WEEE[2]	BC			SMEs	SMEs & BCs			
TOURISM	SMEs[3]							SMEs
CROSS-CUTTING	SMEs & BCs							
RAW MATERIALS			SMEs & BCs	BCs				

Table 2: Matrix of regions and sectors assessed.

TOTAL- refers to the number of questionnaires that have been answered from a SME or BC perspective, thus used for the analysis of each sector.

[1] very few answers were given, thus it was partially considered for the analysis
[2] Waste from Electrical and Electronic Equipment
[3] most answers were NA, thus it was difficult to analyse and compare among regions.

2.3. The analysis

The analysis of the questionnaire that we present in the next chapter was performed from various perspectives:

- general analysis – it identifies the most relevant barriers.;
- by sectors – it analyses the barriers for each sector included in the study;
- by region – it gives an overall picture of the level of circular economy development in each region.

For each barrier category the more relevant sub-categories were also assessed. In all cases, the same semi-quantitative approach was applied in order to qualify the relevance of the barriers assessed.

The quick overview was processed quantitatively by assigning a number –zero, one or two- to each qualitative response - not relevant, important or very important- respectively. The average of all answers was calculated for each barrier subtype. The final scores were then classified as: 'Not relevant' ($\leq$0,5); 'Important' (0,5<IMP<1,5) or 'Very important' ($\geq$1,5). It allowed identifying the most important barriers.

The analysis of the questionnaire was semi-quantitative. The most important barriers were those highlighted by all respondents, as giving the same answer is considered to show consensus in a specific topic. Throughout the report these barriers are highlighted in bold.

The rest of barriers have been classified as 'important', which mean that most respondants believe that they have to be taken into account. The more detailed analysis at the level of sector, region and barrier subtype presented in Chapter 4 provides insights on the meaning of these answers.

Among these 'important' barriers, it is worth mentioning a couple of consequences that could become critical for the development of a global CE. Nowadays it is still rare to account for externalities in the final price of products and services. In fact, most of the respondents did not integrate or measure these costs. In consequence, products and services are currently sold at a lower price than its 'real cost' because an important part of this cost is socialised. Hence, our society pays for the externalities -biodiversity loss, environmental pollution, health problems, and many others- resulting from our current production and consumption model through governments or NGOs. If the development of a CE implies moving towards a 'real priced' economy, then global competitiveness could be lost (at least initially). On the other hand, to boost a CE it is necessary to create proper business ecosystems. To do so, business should convey to a new mind-set where cooperation becomes the centre of their relationships: cooperation along the value chain, cooperation among businesses, and cooperation within businesses.

3. General analysis

The general analysis gives an overview of the barriers that are more and less relevant, without distinction of sectors and regions. Table 3 shows the results of the "quick overview" for all the sectors assessed and based on all the answers provided by the regions. Barriers are classified as not relevant (NR), important (IMP) and very important (VI).

In general, the level of circular economy (CE) integration in different regions and sectors is perceived as medium. However, there is a huge divergence among regions. For instance, while Lower Silesia and Gelderland believe the level of integration is low, Lombardia thinks that it is high.

As per the answers given in the first part of the questionnaire, 'quick overview', and afterwards in the second and more detailed part of the questionaire, **SOCIAL FACTORS** are seen as the main barrier to the implementation of a CE. Social Factors include both businesses' and customers' attitudes.

Internal business culture is seen as the most important sub-barrier for developing a CE. Regardless of the size of the company, "mental frames at the managerial level" or "low interest on green businesses" could hinder the inclusion of a circular economy strategy. Likewise, the **difficulty to understand the concept of Circular Economy** and its implementation, thus the gains it could bring or the costs (time, effort and money) it could incurr, accounts as another important aspect of this barrier. Going a bit deeper, SMEs tend to have a lower level of understanding of CE than Big Corporations (BCs), where there is consensus of having a medium degree of comprehension.

Customers' attitudes are also perceived as critical to the acceptance, thus the implementation, of a circular economy. Both the social demand for green products and the societal readiness to shift from product to service are mostly perceived as being low. Most respondents believe that the information on social and environmental impacts displayed in products is insufficient, and all of them agree that raising awareness on sustainability and circular economy would shift the demand for green products.

Inadequate **legal frameworks** are also highlighted as a barrier to the development of a CE, in particular by SMEs. When deeply analysed, we see that there exists a rather high divergence of opinions and a certain degree of incoherences in the answers given at the second part of the questionnaire on this barrier. However, few conclusions can be drawn:

- The government is expected to play a medium to high leadership role,
- CE national and/or regional targets and objectives are not clear,
- Policy incoherence difficult the development of a CE

Although, the 'quick overview' does not capture any Economic barrier as determinant, most answers given at the second part of the questionaire reveal that the integration of CE is regarded as profitable despite it incurs in additional costs (economic, administrative and transaction) and it is capital intensive. Therefore we could conclude that **Costs** and **Capital** are additional sub-barriers to the development of a Circular Economy. These results seem somehow incoherent. A possible interpretation to it could be that CE becomes an economic enhancer once costs and capital sub-barriers are overcome. Thus, institutional and financial actions should provide the support to reduce as much as possible any economic, administrative and transaction cost and to set the mechanisms to facilitate funding for up-front economic needs

On the other side, there is only one barrier subtype that came to be rather irrelevant for the development of CE, which is the **demand for transparency**. As a general observation, it is a rather surprising conclusion, as transparency implies the sharing of information among companies, which is a delicate subject due to confidentiality and copy rights. However, the fact that most answers to these questions were 'Not Aplicable' may indicate that this aspect was not fully understood by respondents -maybe the question was not properly

framed- or that it was not thoroughly considered. On the contrary, the results obtained from the second part of the questionnaire suggest that most companies acknowledge the existence of many hindrances when it comes to sharing information among companies.

				TOTAL	TOTAL		BIOMASS		RAW MATERIAL		BUILT ENV		FOOD WASTE		PLASTIC		TEXTILE		WEEE		CROSS CUTT		TOURISM
				ALL	*SMEs*	*BIG CORP*	*SMEs*	*BIG CORP*	*SMEs*	*BIG CORP*	*SMEs*	*BIG CORP*	*SMEs*	*BIG CORP*	*SMEs*	*BIG CORP*	*SMEs*	*BIG CORP*	*SMEs*	*BIG CORP*	*SMEs*	*BIG CORP*	*SMEs*
BARRIERS		1	What is the level of Circular Economy (CE) integration perceived in your region?	**5,4**	**5,2**	**4,3**	4,7	4,0	2,0	5,5	4,7	4,5	4,0	6,3	7,5	8,0	4,8	5,3	5,0	10,0	7,3	5,0	5,0
ECONOMIC	**PROFIT**	2	Lack of/low profits	IMP	IMP	IMP	1,0	1,5	1,0	0,5	1,5	2,0	1,2	1,3	1,3	1,5	1,4	1,5	1,5	2,0	0,8	1,0	0,5
	CAPITAL	3	Difficulties to access to capital	IMP	IMP	IMP	1,7	0,5	2,0	0,5	0,5	0,7	1,4	0,5	1,0	1,0	1,2	1,0	1,0	1,0	0,5	0,0	1,0
	COSTS	4	Costs	IMP	IMP	IMP	2,0	2,0	2,0	1,0	1,0	1,0	1,6	1,5	1,3	1,5	1,4	1,3	2,0	1,0	1,3	1,0	1,0
REGULATORY FAILURES	**REGULATORY FRAMEWORKS**	5	Inadequate legal frameworks	VI	VI	IMP	1,7	2,0	2,0	2,0	1,0	1,0	1,8	1,5	1,7	1,5	1,2	1,3	1,5	1,5	1,5	2,0	1,0
	GOVERNMENT SUPPORT	6	Lack of/ low government support	IMP	IMP	IMP	1,0	1,0	1,0	1,5	0,8	1,0	1,2	1,3	1,7	1,5	1,4	1,3	1,0	1,0	1,3	1,0	0,5
		7	Insufficient infrastructure provided by State	IMP	IMP	IMP	0,7	1,0	1,0	1,0	0,5	0,3	1,0	0,8	1,3	1,5	1,2	1,0	1,0	1,0	0,8	0,0	0,5
SOCIAL FACTORS	**INTERNAL BUSINESS CULTURE**	8	Business attitudes towards green business' and 'mental frames at management and opperational levels'	VI	VI	VI	1,3	1,5	2,0	1,0	1,5	2,0	1,8	1,8	1,7	2,0	1,4	1,5	1,5	1,5	1,0	2,0	1,5
		9	Complexity of both CE concept and implementation	VI	VI	VI	2,0	2,0	2,0	1,0	1,3	1,5	1,8	1,5	1,7	2,0	1,6	1,8	1,5	1,5	1,3	1,0	1,5
	CUSTOMERS AND SOCIETY	10	Customers' attitudes and values	VI	VI	VI	2,0	2,0	2,0	1,5	0,7	0,5	1,8	1,7	1,3	1,5	1,5	1,3	1,5	2,0	1,5	1,0	1,0
MAP	**EXTERNALITIES**	11	Lack of internalisation of externalities	IMP	IMP	IMP	0,7	1,0	0,0	0,5	0,7	0,5	1,2	1,3	1,5	2,0	1,5	1,3	1,0	1,0	1,3	1,0	1,0

	BUSINESS COMPETITION	12	Competition with business as usual	IMP	IMP	IMP	1,3	1,0	1,0	0,5	0,8	1,3	1,0	1,0	1,7	2,0	1,8	2,0	2,0	1,5	1,0	0,0	1,5
	BUSINESS ECOSYSTEM	13	Insufficient circularity integration in the supply chain	IMP	IMP	IMP	1,3	1,5	1,0	1,5	1,0	1,0	1,4	1,3	1,5	2,0	2,0	2,0	1,0	1,0	1,5	1,0	1,0
		14	Insufficient infrastructure provided by the market	IMP	IMP	IMP	1,3	1,0	1,0	1,0	0,8	0,7	1,4	0,8	1,7	2,0	1,4	1,3	1,0	1,0	1,7	1,0	0,5
BUSINESS STRUCTURE	**GOVERNANCE**	15	Low internal common view on sustainability	IMP	IMP	IMP	1,3	1,0	1,0	0,5	1,0	1,0	1,0	0,7	0,7	0,5	0,6	0,8	1,0	0,5	1,3	2,0	0,5
		16	Demand for transparency	NR	NR	NR	0,0	0,0	0,0	0,0	0,3	0,0	0,8	0,7	0,5	1,0	0,8	1,3	1,0	0,0	0,8	1,0	0,0
	ADDITIONAL COSTS	17	Additional administrative burden	IMP	IMP	IMP	1,3	1,0	1,0	0,5	0,3	0,5	1,3	1,0	1,5	1,0	1,0	0,7	1,0	2,0	2,0	2,0	1,0
		18	Additional transaction costs	IMP	IMP	NR	1,0	0,5	0,0	0,0	0,3	0,5	1,0	0,7	1,0	1,0	1,5	1,3	1,0	0,0	1,0	0,0	1,0
TECHNOLOGY + KNOWLEDGE	**ACCESSIBILITY**	19	Difficult access to appropriate green technology	IMP	IMP	IMP	0,3	1,0	0,0	0,0	1,5	1,0	1,0	1,0	1,0	2,0	1,8	1,7	1,0	2,0	0,8	2,0	1,0
	SKILLS	20	Lack of skills and capabilities	IMP	IMP	IMP	1,0	1,5	2,0	1,5	0,8	0,7	1,2	1,0	1,0	1,5	1,2	1,0	1,0	0,5	1,5	1,0	1,0

Table 3: Results of the 'quick overview' analysis

NR- not relevant- ≤0,5 (light blue)
IMP- Important 0,5<IMP<1,5 (white) VI- Very important ≥1,5 (dark blue)

4. Sectorial analysis

The sectorial analysis identified the most and least important barriers to the development of a Circular Economy in each sector. SMEs and Big corporations were treated separately as most respondants differentiated between both of them when answering the questionnaire.

The number of answered questionnaires received for each sector differs substantially because not all project partners have assessed all sectors -see Table 2 to view these differencies-. In order to show the robustness of the results, at the beginning of each sectorial chapter the number of answered questionnaires received both from SMEs and Big corporations is mentioned.

4.1. Biomass

Results are based on the answers provided by Lombardia, Gelderland and Lower Silesia (both for SMES and BCs in all regions).

The perceived level of Circular Economy (CE) integration in the biomass sector was around 4 (over 10), and was much higher in Lombardia (around 8) than in Gelderland (around 5) or Lower Silesia (around 3).

Economic Barriers, Social Barriers and Regulatory Failures were revealed as the most important barriers to the development of a CE.

Economic barriers

While Big Corporations (BCs) believe Circular Economy is profitable, SMEs do not have the same perception.

We departed from the assumption that profit encompasses both tangible and intangible benefits. When asking for tangible benefits, thus the economic return from introducing CE, most companies, and in particular SMEs, stated that they were unable to measure them. Intangible returns from innovation on CE were perceived differently by BCs and SMEs. The former believed that there was a medium return after 2 to 5 years time, and the later thought that such pay off was not acceptable.

In order to accelerate profit, the sector appointed the development of regulatory frameworks at the national level as one of the tools that could create incentives and favourable tax policies for companies and start-ups embrancing circular economy.

Both BCs and SMEs thought that **CE integration would incurin additional costs and is capital intensive**, although none of them could give any details on any of these aspects. Access to funding from banks was not seen as a problem, while access to other financial sources was stated to be difficult in some occasions.

Regulatory failures

Respondents stated that all regions were subject to their national regulatory frameworks. However, respondents from Gelderland and Lombardia also pointed out having regional responsabilities (competences) in CE, and therefore, they seemed to be aware of the regional regulatory and policy

frameworks in place (this was not the case of Lower Silesia). However, with the exception of Lombardia's[1] SMEs, there was a general consensus that **national targets and objectives to develop a CE were not clearly defined**.

Within this sector, there was no consensus on the level of influence that local authorities have on companies nor on the leadership role of the government for the CE transition, since responses varied significantly according to region and company size.

Regional regulatory frameworks, which were perceived to influence differently BCs and SMEs, seemed to have a middle effect on companies and to be moderately enforced. In general, BCs were more able to participate in regional CE innovation networks and better capacitated to comply with regulation.

Policy incoherences affected most regions. In this sense, the "incoherence between incentives for recycling and authorization for using second raw materials" was mentioned by Lombardy.

Social factors

The integration of sustainability as a business strategy in the sector ranged from medium to low, and it was lower in SMEs than BCs.

Some reasons to explain it could be:

- the degree of **CE understanding among managers and staff** was lower in SMEs than in BCs;
- the **adoption of green strategies seemed to depend hihgly upon managers' attitudes**.
- The **demand for green products was still perceived as medium to low** (BCs sense that the demand is medium, while SMEs sense that it is low).
- The social readiness to shift from products to services was still low.

In order to improve the comprehension of circular economy within companies and also among the society, the sector proposed the development of communication initiatives (fairs, networks, consultation points, campaigns, education,…). There was a general consensus that there **is not enough information on the social and environmental impacts of product production** and that **increasing awareness on sustainability would shift the demand for green products**.

Market failures

The internalisation of externalities is still pending in the sector. According to the respondents, there are no regulatory frameworks taking into account the costs of externalities, which, at the same time, are poorly known both by SMEs and BCs. In consequence, their inclusion in the final price of products and services is rather low.

On the other hand, companies believed that the price of raw materials and oil had a medium (for SMEs) to high (for BCs) influence on the final costs of products and services, thus also affecting significantly innovation towards resource efficiency. Increasing the scope of "Extended Producer Responsibility" to furniture was one of the tools proposed by Lombardia to take externalities into account.

[1] Lombardia answers the questionnaire only from the Biomass Wood perspective

When considering the full value chain, most companies in the sector valued cooperation within it as an opportunity. They also thought that the position/role in the value chain determined the adoption of CE strategies. The level of influence on their suppliers was perceived as low in the case of SMEs and medium in the case of BCs, which also believed that such influence conditioned the shifht to 'green supply chains'. **BCs** observed **globalisation** as a barrier to the development of a CE.

Besides all issues related to regulation, incentives and information, connecting the new value chains of biomass producers with manufacturing industries was put forward by Gelderland as a means to create a business ecosystem that would contribute to accelerate the transition towards CE.

Business

The level of CE integration within hierarchical levels was considered to be medium, both in SMEs and BCs. It is stated that the internal structure of companies and the way CE is integrated and led could compromise the development of a CE. In this sector there was a general consensus on the structure needed to integrate CE:

- It should be led at the level of management and directors.
- In BCs it was the responsibility of several departments. In SMEs, it could depend upon one department.

Considering that sharing information is another big step forward to the implementation of a CE, it is worth mentioning that, in this sector, SMEs believed that sharing information among companies was difficult, while BCs assured that it was rather easy. Instead, sharing information within the company, that is, among departments, was perceived as easier in SMEs than in BCs, that considered it to be difficult. To improve transparency the respondants suggested the implementation of procedures, sustainability reports, etc.

The main barriers identified to the development of a CE were imperfect information and additional costs, that included administrative burden related to monitoring and reporting, meeting standards and legal obligations, and reporting in different formats; and transaction costs such as bargaining costs or legal obligations.

Technology

In general, access to both technology and skilled professionals werenot seen as barriers to the development of a CE. There was no consensus on the technological aspects that were less developed, but economic incentives for R&D, and acess to green technologies were two of the most highlighted. CE is not yet included in educational curricula, although most respondants thought that it should be, both at University level and at schools. R&D was seen as key to create new and innovative technology.

4.2. Built environment

Results are based on the answers provided by London, Gelderland, Sofia and Lombardia (four questionnaires for SMEs and four for Big Corporations). However, two questionnaires (one for SMEs and one for BCs) were not fully taken into account because they were answered partially.

The built environment sector recognised the level of Circular Economy integration as medium-low (around 4,5 over 10). Again, it was much higher in Lombardia (around 8) than in Gelderland (around 3) or Sofia (around 3).

Social Factors were seen as the most important barrier to the development of a CE.

Economic barriers

Both BCs and SMEs in this sector believe that Circular Economy is profitable. It is worth mentioning that the 'quick overview' appoints 'lack of/low profits' as one of the main barriers to the development of a CE, which goes against the results obtained from the questionnaire.

We departed from the assumption that profit encompasses both tangible and intangible benefits. When asking for tangible benefits, thus the economic return from introducing CE, most companies stated that they were able to measure them. Tangible and intangible returns from innovation on Circular Economy are perceived as acceptable, with a medium pay-back period of 2 to 5 years' time. Only Gelderland disagrees with this pay off time, as respondents from this region think that it is over 5 years, thus not acceptable.

In order to accelerate profit, the sector appoints to the development of regulatory frameworks, such as public procurement procedures, planning requirements or business support schemes.

Both BCs and SMEs think that **CE integration is capital intensive**, as it implies the availability of initial capital to set up new business practices. Moreover, it is perceived that CE integration often incurs in additional costs. Some examples are the purchasing of new equipment, the implementation of new techniques, staff training, etc. Better access to training, support for innovation and tax exemptions are some tools that could be introduced to reduce extra costs. Access to funding from banks or other financial sources is not seen as a problem.

Regulatory failures

Respondents stated that all regions were subject to their national regulatory frameworks. Besides, repondents from Gelderland and Lombardia also pointed out having regional responsibilities (competences) in CE. At this point, it is worth mentioning the existence of a Circular Economy Route Map in London and the so-called "Protocol ANCE Lombardia" in Lombardia.

In Sofia, in compliance with the Republic of Bulgaria's commitments to implement the requirements of EU waste management legislation, a National Strategic Plan for the Management of Construction and Demolition Waste was approved for the Period 2011-2020 and the Construction and Waste Management Regulation of recycled building materials was adopted by Decree of the Council of Ministers 277 of 5.11.2012, prom. 89 of 13.11.2012, in force as of 13.11.2012 (NSPMCDW). The adopted legislation provides a new management model of construction waste

In the case of Gelderland, all kinds of regulation to boost sustainability in the building and construction sector are in place at national level. At regional level, Gelderland launched a policy plan on circular economy in 2017 (concerning the disposable economy). One of the three elements is green procurement in construction and roads.

In general, SMEs believe that national targets and objectives to develop a CE are well defined. There is no consensus for BCs.

Within this sector, there is no consensus neither on the level of influence that local authorities have on companies nor on the effectiveness of regulatory frameworks , since answers vary significantly among regions and company size. Conversely, respondents believe that regulatory frameworks influence equally both BCs and SMEs.

All respondents believe that the government should have a leadership role in this transition.

Policy incoherencies have been identified with regards to environmental, recycling and waste policies.

Social factors

The integration of sustainability as a business strategy in the sector was perceived as medium both in SMEs and BCs. Business culture and social attitudes were considered to be critical to the development of a CE.

In this sector,

- the level of CE understanding among managers and staff was observed as medium;
- the **adoption of green strategies depended upon managers' attitudes**.
- The **demand for green products was still perceived as being low** (only London thinks that it is medium).
- The social readiness to shift from products to services was still perceived as low.
- Low cost consumption culture was seen as a potential barrier to the social acceptation of a CE.

There was a general consensus that there **is not enough information on the social and environmental impacts of product production** and that **increasing awareness on sustainability** via campaigns or events **would shift the demand for green products**.

Market failures

The internalisation of externalities was perceived as low in this sector. The lack of knowledge on the costs of externalities and the inexistence of regulatory frameworks is thought to entail a **low inclusion of the cost of externalities in the final price of products and services**.

Except for London, there was a general opinion that the price of raw materials and oil has a low impact on both the final costs of products and services, and innovation towards resource efficiency.

Establishing a system to measure externalities was one of the tools that Lombardia proposed to take externalities into account.

When considering the full value chain, most SMEs believed that the adoption of CE strategies is independent of their position within it. They valued cooperation within the value chain as an opportunity that could be determinant to develop a CE. Instead, there was not a clear position around these issues among BCs.

Globalisation is not seen as a barrier to the development of a CE.

The perception on the level of influence that companies have on their suppliers depends on the region, as it is high for Gelderland, medium for Sofia and low for Lombardia. However most of them agree that influencing suppliers would push for a shift to 'green supply chains'.

In general, it is stated that improving regulation, developing incentives, and increasing understanding of CE concepts (design for deconstruction, reuse of materials,...) would contribute to create a business ecosystem to accelerate the transition to CE.

Business

The level of CE integration within hierarchical levels was considered to be low in SMEs. There was no consensus on BCs. In this sector, there was a general consensus on the structure needed to integrate CE:

- It should be led at the level of management and directors.
- It should be the **responsibility of several departments** (most of them).

A dynamic and creative business structure, together with R&D could help the integration of CE within companies.

Taking into account that sharing information is another big step forward towards the implementation of a CE, SMEs in this sector believed that sharing information among companies was difficult, while BCs did not reach a consensus on this issue. Instead, sharing information within the company, that is, among departments, was perceived as easy in BCs, and relatively easy in SMEs.

To improve transparency, respondents suggested public awareness campaigns.

Additional administrative and transaction costs **were revealed as another barrier subtype to the development of a CE.** Again, this conclusion went against the 'quick overview' results. In relation to administrative burden, some of the aspects highlighted were monitoring and reporting, meeting standards and legal obligations, reporting in different formats, and certifications and labels procedures (SMEs). **Search for information was the major transaction cost**. Collaboration and business' networks creation were seen as two possible actions to reduce these costs.

Technology

In general, low **knowledge of technology innovations and the lack of skilled professionals were seen as obstacles to the development of a CE**. There was no consensus on the technological aspects that are less developed, but eco-designed products, quality of final redesigned or recycled products/materials and advanced green technologies were the most highlighted. CE is not yet perceived to be included in educational curricula, and some respondents mentioned the need for specific educational programs.

Collaboration among universities, local authorities and companies is one of the tools proposed to decrease the gap between technology development and businesses.

London appointed "Opportunities to scale up small businesses" and "lack of metrics to measure progress" as other potential barriers to the development of a CE.

4.3. Plastics

Results are based on the answers provided by London, Lombardia and Hauts-de-France (two questionnaires from SMEs and one from a BC). The low number of answers weakens the results.

Respondents from this sector thought that the level of Circular Economy integration was high.

Economic and social factors, and regulatory frameworks are the main barriers to the development of a CE in this sector.

Economic barriers

Circular Economy was observed as profitable in the sector. Respondents state that economic benefits from CE can be measured and that a pay-back period from innovation ranging from 2 to 5 years is acceptable. It is considered that public procurement and the improvement of EU regulations could help increase profit.

The sector thought that CE integration was **capital intensive** and it **incurred in additional financial costs**. In this sense, it is stated that the inclusion of circularity implies investing up-front money to build new plants or to improve the existing ones, and developing new products. Better access to training, financial support and consulting are proposed to reduce such burden.

Funding from banks seemed more or less accessible depending on the region, while other financial sources were not observed as a problem. Again, it is emphasized that public financial support would help overcoming these barriers.

Regulatory failures

All surveyed regions mentioned having **responsibilities** (competences) in circular economy at a regional level, which are supported by current **regulatory and policy frameworks**, at either regional or national levels.

The level of **regulatory influence that local authorities** have on companies was perceived as **medium** and no differences were observed between answers from BCs and SMEs. On the other hand, companies believed that the level of effectiveness and enforcement of the existing legislation was medium. Consumers and society are envisaged as the main drivers for sustainability improvements in the sector. A simple and non-bureaucratic regulation tailored to company needs; together with public procurement were some of the tools mentioned to improve regulatory support on companies.

Some surveyed companies believed that national targets and objectives to develop a CE were well defined. These companies also thought that the government was in charge to lead this transition through public procurement and proper regulations.

Social factors

The integration of sustainability as a business strategy was felt to be low to medium within the sector.

In this sector,

- The level of CE understanding among managers and staff was perceived as **medium**;
- **Managers' attitudes** were appointed as **critical** to the adoption of green strategies
- The demand for green products was perceived as low to medium, depending on the region.
- The social **readiness to shift from products to services** was observed to be **low**.
- **Consumption culture** was identified as the main barrier to the social acceptation of a CE.

There was a general consensus that **increasing awareness on sustainability would shift the demand for green products**, although some regions believed that information on the social and environmental impacts of product production was sufficient.

Market failures

Once again, **the internalisation of externalities** was revealed to be **low**. Respondents also pointed out that:

- The internalisation of externalities is **not underpinned by regulatory frameworks,**
- **Externalities costs were rather unknown**, and
- The **price of raw materials and oil strongly impact on the final costs of products,** and sometimes could affect innovation towards resources efficiency.

When considering the full value chain,

- Some companies believed that the adoption of CE strategies depended upon their position within the value chain.
- Business cooperation within the value chain was regarded as an opportunity that could become a key leverage to the development of a CE.
- The level of influence on suppliers was perceived as rather low (although it could leverage the shift to a green supply chain).
- Globalisation was not seen as a relevant barrier.

There was not a clear idea on how to create a business ecosystem to accelerate the transition to CE, as each region identified various and very different aspects, such as regulation, awareness or public administration instruments.

Business

Companies in this sector believed that the degree of CE integration within hierarchical levels was medium in BCs. In this sector there was a general consensus on the structure needed to integrate CE:

- It should be led from top management positions.
- It is the responsibility of several departments, such as research and development, purchasing, human resources and marketing.

Considering that sharing information is another big step forward to the implementation of a CE, the sector believed that **sharing information** among companies and within the company, that is, among departments was **difficult**. Confidentiality was mentioned as the ultimate reason to it.

To improve transparency respondents suggested using life cycle analysis and indicators such as ecological footprint.

Imperfect information and **additional costs were additional barrier subtypes**. Simplification on both administrative and transaction procedures were proposed as tools that could reduce these costs.

Technology

Companies declared not being fully aware of technological innovations. To overcome this situation, they put forward actions such as networking activities (e.g. workshops, hackathons or best practices events).

It was not clear whether there is a lack of CE professionals and skilled employees, but this issue did not seemed to be of concern, likewise the fact that CE is not yet included in educational curricula (except for Lombardia).

London appointed "Opportunities to scale up small businesses" and "lack of metrics to measure progress" as other potential barriers to the development of a CE.

4.4. Food waste

Results are based on the answers provided by Lower Silesia, Catalonia (Beverage sector), London, Lombardia and Sofia (four SMEs questionnaires and three BCs questionnaires).

The level of Circular Economy integration in the food waste "sector" is perceived as medium, although it differs according to company size and region. For instance, it is lower in SMEs (around 4,0 over 10) than in BCs (6,3), and in Lower Silesia than in Catalonia or Lombardia.

Social Factors are, once more, the most important barrier to the development of a CE. However, economic costs and inadequate legal frameworks are also relevant in this sector.

Economic barriers

Both BCs and SMEs in this sector believe that Circular Economy is profitable.

As pointed out, we consider that profit encompasses both tangible and intangible benefits. When asking for tangible benefits and, in particular, for the economic return from introducing CE, most companies and specifically BCs, stated being able to measure them. In some occasions, SMEs mentioned that they had

neither the capacity nor the tools to do it. Intangible returns from innovation on Circular Economy are perceived by BCs as acceptable, with a medium pay-back period of 2 to 5 years' time. Instead SMEs, believe that the pay-back period is too long, thus not acceptable (with the exception of Lombardy).

In order to accelerate profit creation from CE actions, the sector appoints two different types of tools: those related to economic incentives, such as tax reductions, fiscal incentives or funding, and those related to awareness and communication, such as public procurement, campaigns and collaborative platforms.

Both BCs and SMEs think that **CE integration is capital intensive**, as: a) it implies investing up-front money to change production processes and to develop or acquire new technology, and b) **it incurs in additional costs** related to machinery, materials and training. Better access to training, fiscal incentives, support for innovation and development of economies of scale and promotion of best practices are some tools that could be introduced to reduce extra costs. Access to funding from banks or other financial sources is not perceived as a problem.

London appointed "Opportunities to scale up small businesses" and "lack of metrics to measure progress" as other potential barriers to the development of a CE.

Regulatory failures

According to respondents, Catalonia, Lombardia and Sofia have responsibilities (competences) in circular economy at regional level through regulatory frameworks related to environmental and waste issues, whereas Lower Silesia is not considered to have any responsibilities. It is worth mentioning that Lombardia and London pointed out having both regulatory and policy frameworks in place.

However, both SMEs and BCs believe that **national targets and objectives** to develop a CE are **not well defined**.

Within this sector, there is no consensus among BCs on the level of regulatory influence that local authorities have on companies. SMEs believe that it is medium. On the other hand, while BCs consider that the levels of effectiveness and enforcement of the CE legislation are medium, there is no consensus among SMEs.

SMEs agree that the government should have a leadership role in this transition. BCs seem somehow less confident in governmental leadership. Most regions believe that the government should provide platforms and logistics to manage circular processes. Moreover, it is stated that the government should drive changes on waste legislation and consumption practices, facilitate funding and include CE in public procurement.

Social factors

The integration of sustainability as a business strategy in the sector is medium to high.

In this sector (both for BCs and SMEs),

- the level of CE understanding among managers and staff is believed to be medium to low;
- the adoption of green strategies in most cases is perceived to depend upon managers' attitudes;

- the demand for green products is perceived as medium to low;
- the social readiness to shift from products to services is considered to be rather low;
- the preference for new versus second hand and low cost culture are seen as barriers to the social acceptation of a CE.

There is a general consensus that there **is not enough information on the social and environmental impacts of product production** and that **increasing awareness on sustainability** via campaigns, education, eco-labeling or collaboration with social organisations (church, NGOs…) **would shift the demand for green products**.

Market failures

In this sector the internalisation of externalities is perceived as low because,

- it is **not underpinned by regulatory frameworks**, and
- the costs of externalities are rather unknown.

However, Lombardia and Sofia's SMEs stated that they include these costs in the final price of products when known.

There is a general opinion that the price of raw materials and oil has a medium to high impact on both the final costs of products and services, and innovation towards resource efficiency.

When considering the full value chain,

- Most SMEs believe that the adoption of CE strategies depends upon their position within the value chain. Instead, BCs think that it is rather independent of it.
- Both SMEs and BCs **value cooperation within the value chain as an opportunity** that could be determinant to develop a CE.
- SMEs consider having a low influence on suppliers.

Globalisation is seen as a medium to high barrier to the development of a CE.

While BCs agree that influencing suppliers would push for a shift to 'green supply chains', SMEs do not.

There is not a clear idea on how to create a business ecosystem to accelerate the transition to CE, as each region has stated various and very different aspects, including information exchange, networking, funding schemes at the value chain level, reverse logistic schemes, lobbying or public procurement.

Business

The level of CE integration within hierarchical levels is considered to be low in SMEs. There is no consensus on BCs. In this sector there is a general consensus on the structure needed to integrate CE:

- It should be led at the level of directors.
- In BCs it is the **responsibility of several departments**.

Sharing information is another big step forward to the implementation of a CE. The sector believes that there are many obstacles for **sharing information among companies**. Instead, sharing information within the company (that is, among departments) is acknowledged as easy in the case of SMEs, and difficult in the case of BCs, mainly due to long communication chains and the large size of these companies. Imperfect information could negatively affect market decisions.

To improve transparency, respondents suggest tools such as certification, traceability and public registries.

The main barrier to the development of a CE concerning business aspects is related to additional internal costs, that include administrative burden and transaction costs. In relation to administrative burden, some of the aspects highlighted are monitoring and reporting, meeting standards, certifications and labels, legal obligations and policy enforcement. Standardization and development of guidelines are seen as two possible actions to reduce these costs.

Technology

SMEs seem distant from technology innovation, as they reveal not being always aware of existing technological innovations and finding it difficult to recruit skilled professionals. BCs, instead, do not show a predominant opinion on it.

Respondents point out that CE is not yet included in educational curricula, although some of them think there should be specific educational or vocational training programs on eco-design and CE.

Research is seen as the main mechanism to decrease the gap between technology development and business, which could be spurred through long-term investment plans and networking events (hackathons, workshops…).

4.5. Textile

Results are based on the answers provided by Hauts-de-France, Catalonia, London, Lombardia and Gelderland (four SMEs questionnaires and three BCs questionnaires). The textile sector is thus one of the sectors with more information.

The integration of Circular Economy in this sector strongly differs among regions. For instance, it is perceived to be very low in Catalonia (2/3) but quite high in Hauts-de-France (8).

This sector identified monetary and non-monetary costs, regulatory frameworks, customers' non readiness for CE and transparency as the aspects that could hinder the development of a CE.

Economic barrier

Both BCs and SMEs in this sector recognised the profitability of Circular Economy. All of them declared being able to measure it, except for a few SMEs. It was mentioned that SMEs did not have any accountability systems in place to calculate the revenues from recovering textile waste, which made it difficult to measure economic benefits.

Returns from innovation on Circular Economy were perceived as medium. When asking for the pay-back period of innovation, most BCs thought that it was too long. Instead, most SMEs perceived it as acceptable (2 to 5 years' time). In order to reduce the investment pay-back period as a means to increase profit, there was general consensus that financial incentives, bonuses for good practices, and support for research and innovation would make a difference.

Both BCs and SMEs thought that **CE integration was capital intensive**, as it implied investing up-front money to change production processes and procedures (including materials, technology…) which were associated to a high level of success uncertainty. Moreover, **CE is considered to incur in additional costs** related to management, service and product rethinking and staff training. Better access to training and public support to research and innovation were some of the tools that could be introduced to reduce extra costs.

The scale was, for the first time in this study, seen as a challenge to be overcome for the development of a CE. Gelderland wrote: "*For the textile industry the scale of production and the location of production are very important (large capacities in low-cost countries). Circular textile products, notably pilot introductions, cannot be realized (developed) in the regular production chain, dedicated development cooperation with innovative suppliers is needed in smaller quantities, which incurs additional production costs.*"

Respondents acknowledged the existence of some hindrances when it comes to accessing to funding from banks, while other funding sources were considered to be more accessible. Again, companies demanded more public financial support.

Regulatory failures

Respondents from this sector from all surveyed regions stated that their regions had responsibilities (competences) in circular economy at a regional level, yet most of them pointed out that they did not have any specific CE regulatory frameworks in place. Instead, most regions are considered to have policies related to environmental and waste issues that either include aspects of CE or indirectly influence the development of CE (although sometimes companies were not aware of such link).

Within this sector, there was not a consensus among SMEs on the level of influence that local authorities have on companies (which varies between medium and low). BCs felt that it was low. On the other hand, both BCs and SMEs believed that **the levels of effectiveness and enforcement of CE legislation**[2] were **medium**. The need for legislative simplification and concretion in order to specifically facilitate the implementation of a CE was stated by Lombardia. For instance, aspects such as traceability, labelling, networking or schemes for recovery and recycling of textile waste were mentioned.

SMEs believed that national targets and objectives to develop a CE were not well defined. BCs were more positive with this statement.

SMEs agreed that the government should lead the CE transition. BCs expected the government to play a lower profile. Most respondents believed that the government should act as a coordinating body whose role would be to compile and disclose data/ information related to textile waste, valorisation, technology and knowledge.

At the moment most surveyed companies were not aware of policy incoherences, although some mentioned that the transposition of European directives into national policy frameworks depended upon the interpretation of each country.

[2] It is important to clarify that this sector referred to CE legislation as those policies directly or indirectly related to CE, such as environmental issues or waste.

Social factors

In general, the integration of sustainability as a business strategy in the sector was perceived as medium (although respondents in Gelderland considered it to be low).

Companies from this sector (both SMEs and BCs) observed that,

- The level of CE understanding among managers and staff was medium. In this sense, it was pointed out that probably training and awareness would help improving it.
- The adoption of green strategies depended significantly upon managers' attitudes.
- The demand for green products was medium to low.
- **The social readiness to shift from products to services was low**.
- The preference of new versus second hand and low cost culture were obstacles to the social acceptation of a CE.

Once again, there was a general consensus that there is not enough information on the social and environmental impacts of product production and that **increasing awareness on sustainability would shift the demand for green products**. It is considered that people's preference for new and property owned items may hamper social acceptance of a CE.

Market failures

Depending on the region the perception on the internalisation of externalities in the textile sector ranged from low to medium. In general, there was the perception that:

- CE was **not underpinned by regulatory frameworks,**
- Externalities costs were rather unknown, and
- The price of raw materials and oil had a medium to high impact on both the final costs of products and services, and innovation towards resource efficiency.

Concerning the inclusion of externalities in the final price of products and services, SMEs in Catalonia mentioned that it could weaken competitiveness in a global market. In that sense, globalisation was specifically identified as an added difficulty towards the acknowledgement and integration of externalities. Should externalities be taken into account at European level, European companies' competitiveness would decrease with respect to other companies'[3] competitiveness in the global market. Local production, public procurement, pricing schemes or awareness rising could help overcome this barrier. Surprisingly, when specifically asking about globalisation as a potential barrier to CE, most answers were rather moderate.

When considering the full value chain,

- Most companies believed that the adoption of CE strategies depended upon their position within it.
- Both SMEs and BCs **valued cooperation within the value chain as an opportunity** that was **determinant** to develop a CE.

[3] It is not explicitly mentioned but we understand that respondants mean non European companies

- SMEs and BCs considered having a low and medium influence on suppliers, respectively. Both agreed that **influencing suppliers would push for a shift to 'green supply chains'**.

There wasn't a clear idea on how to create a business ecosystem to accelerate the transition to CE, as each region stated various and very different aspects, including public procurement, traceability information, textile waste collection (B2B), certification standards, value chain cooperation mechanisms, or public awareness.

Business

The level of CE integration within hierarchical levels was considered to be medium in SMEs. There was no consensus on BCs. Interestingly enough, in this sector there was a general consensus on the structure needed to integrate CE:

- It should be led from high hierarchical levels, such as owners, CEOs, directors...
- It is the responsibility of **several departments**, such as production, research and development and purchasing.
- A strong company vision that translates into coherent and cross-cutting CE goals and indicators.

Sharing information was seen as another big step forward to the implementation of a CE. The sector believed that due to competition within the sector **sharing information among companies was difficult.** Thus it was identified as the main business barrier subtype to the development of a CE.

There was no consensus among respondents from different regions on the level of difficulty to share information within the company, that is, among departments. It was stated that building up trust and confidence could facilitate it.

To improve transparency the respondents suggested certification, traceability and public registries.

Administrative burden and transaction costs were considered extra difficulties to the development of a CE. In relation to administrative burden, some of the aspects highlighted were monitoring and reporting (in different formats for each administration), certifications and labels. In relation to transaction costs, fees and charges, policy, legal obligations and enforcement were the most commonly mentioned. Proper regulation and standards, as well as business support schemes, were proposed as actions to reduce these costs.

Technology

BCs felt aware of existing technological innovations. SMEs, instead, did not show a predominant opinion on it, but, in general, they seemed to lack information. Knowledge transfer and access to capital regarding R&D are some of the tools mentioned to approach technology to companies, and in particular, SMEs.

In general, companies did not express any concern about neither internal nor external skilled professionals. However some respondents mentioned that the lack of adequate technologies and materials, of technological know-how, and of technically qualified personnel were additional difficulties to fully implement CE.

CE was perceived to be included in educational curricula.

Research and training were seen as the main mechanisms to decrease the gap between technology development and business.

A relevant observation was made by Gelderland about external hindrances to transit towards a CE: *the fact that the linear business model will be in place for the next decade discourages the transition towards a CE while it poses more pressure on the need to highlight the added value of CE gains and evidence that the linear model cannot be sustained anymore.*

In order to boost the transition to a CE in the textile sector, Gelderland proposed to pursue a European Open Innovation Centre for Circular Textiles for a transition period of 10 years, moving from an initial operational funding of 80/20 public/private to 20/80 in 10 years.

4.6. WEE

There was not enough comparable data for the analysis of this sector, therefore it was only analysed as part of a region.

4.7. Tourism

Slovenia values integration of Circular Economy in the tourism sector as medium. Lack of **Regulatory frameworks is the main barrier** to the development of a CE in this region and sector.

The analysis is mainly based on the information provided by Slovenia (one questionnaire to SMEs) since Lombardia did not answer all the questions of the questionnaire, in particular those related to Economic, Regulatory Framework and Technology barriers.

Economic barriers

Respondents from this sector **do not perceive economy as a barrier** to the development of a CE. Instead, they think that CE is profitable and that investments on innovation have a medium pay-off period of 2 to 5 years. Furthermore, they do not observe CE integration as being capital intensive although they agree that it can incur in additional costs. It is considered that subsidies (a combination of favourable loans, an active promotion of the company and an appropriate infrastructure for the implementation of the circular economy) would even increase profit.

Respondents from the sector envisage that savings from energy and material use in a circular process would compensate for the increased volume of work and transition investments. Support from EU funds or national funds for pilot cases and low taxes are proposed as tools to facilitate the transition.

Regulatory failures

Although responsibilities and regulatory frameworks on CE are considered to depend on the national level, Slovenian companies recognise the influence of local authorities. However, the effectiveness and enforcement of any regulation on CE is perceived as low.

Sustainability improvements are stated to be led by public opinion: "*by purchasing in sustainable companies you contribute to preserving the environment*". Some of the suggestions made on regulatory support were: higher taxes for "*those who do nothing for the CE*", harmonization of various regulations or "*state's seriousness*". Nevertheless, respondents believe that "*we will not set up a CE with regulation, but with awareness, investment in infrastructure and evidence that the introduction of CE for companies has a long-term return".*

Respondents from both regions felt that national targets and objectives to develop a CE are not clearly defined. In terms of infrastructure, a lack of connections to green energy, sustainable mobility and efficient public transport were mentioned. Lower taxes and financing the necessary investments were some of the tools pointed out to accelerate the transition towards a CE.

Social factors

The integration of sustainability as a business strategy in the sector was perceived as medium.

Respondents from this sector observed that,

- **The level of CE understanding among managers and staff was medium**.
- The adoption of green strategies depended significantly upon managers' attitudes
- The demand for green products was medium to high.
- The **sense of convenience** was seen as an obstacle to the social acceptance of a CE.

Respondents from Slovenia think that there is not enough information on the social and environmental impacts of product production and that increasing awareness on sustainability would shift the demand for green products.

Market failures

The perception on the internalisation of externalities in the tourism sector was medium. In general, there was the perception that:

- Externalities costs were known, and
- **The price of raw materials and oil had some influence on the final costs of products and services**,
- Innovation towards resources efficiency depended upon the price of resources.

When considering the full value chain,

- Collaboration among businesses within the value chain was considered to be an opportunity
- Globalisation was observed as a barrier to the development of CE
- Companies in this sector considered having a medium influence on suppliers.

There was not a common idea on how to create a business ecosystem to accelerate the transition towards CE. Specific legislation, education and financial instruments to promote companies' networks, or connections to green energy were some of the tools put forward in this sense.

Business

Companies from this sector considered that the integration of CE had to be driven from management positions and spread throughout all departments. Furthermore, respondents from Slovenia believed that

"*the exchange of information is easy with the use of Internet and information support in its own organization"* and Lombardia mentioned that "*transparency was not perceived as a problem for the sector*".

Administrative burdens and transaction costs were considered by Slovenian respondents as extra difficulties to the development of a CE. They mentioned monitoring and reporting, reporting in different formats for each administration and certifications and labels as major administrative burdens.

Technology

Technical know-how was the least accessible technological aspect according to this sector.

Slovenian companies worried about the lack of competent professionals, although they did not consider employees skills as an addition difficulty to adopt CE strategies. "*Education, presentation of practical examples and effects" would help boosting professionals*' knowledge on CE.

It was also mentioned that CE was not yet included in educational curricula.

4.8. Raw materials

The analysis is based on one questionnaire for SMEs and two questionnaires for BCs, from two different regions (Lower Silesia and Sofia).

The level of Circular Economy integration in the raw material sector is low in SMEs, and medium in BCs.

Social factors and regulatory failures are the two main barriers to the development of a CE.

Economic barriers

BCs believed that Circular Economy was profitable, as they considered that its economic benefits could be measured, and perceived the returns from innovation as acceptable with a pay-back period of 2 to 5 years. On the contrary, SMEs did not see CE as profitable.

SMEs think that CE integration is capital intensive and that it incurs in additional costs. It is stated that the inclusion of circularity implies investing up-front money to change production processes and procedures (including materials, technology…), to purchase new machinery or to implement new business models. It also pointed out that it implies investing in staff training, R&D and management. There is no consensus among BCs.

Access to funding from banks did not seem to be a problem while other funding sources were perceived as being less accessible. Again, the need for public financial support was stated.

Regulatory failures

Both surveyed regions, Lower Silesia and Sofia, are considered **neither to have any responsibilities (competences) in circular economy at regional level, nor any regulatory framework in place**. However, it was pointed out that Lower Silesia had some policies related to waste management in place.

In this line, surveyed companies believed that **national targets and objectives to develop a CE were not well defined**.

The level of regulatory influence that local authorities have on companies was perceived as medium or high. On the other hand, companies believed that the levels of CE-related legislation effectiveness and enforcement were medium[4]. Internal environmental policies seem to drive sustainability improvements in both regions. Establishing annual targets, proper industrial guidelines on waste management or national monitoring systems were some tools mentioned to improve regulatory support on companies.

Both SMEs and BCs thought that governments should lead the transition towards a CE by creating secondary raw material market platforms.

Surveyed companies were not aware of any policy incoherences.

Social factors

The perceived integration of sustainability as a business strategy varied substantially within the sector.

Moreover, in this sector,

- The level of CE understanding among managers and staff was considered to be variable. Training, awareness and guidance are put forward as possible means to improve it.
- The adoption of green strategies was stated to depend significantly upon managers' attitudes.
- The demand for green products was perceived as rather low.
- The social readiness to shift from products to services was seen as low.
- Preference of new versus second hand and low cost culture were perceived as barriers to the social acceptation of a CE.

There was a general consensus among respondents that there is not enough information on the social and environmental impacts of product production and that **increasing awareness on sustainability would shift the demand for green products**.

Market failures

In this sector the perceived internalisation of externalities is rather low. Besides, respondents stated that,

- This internalisation was not underpinned by any regulatory frameworks
- Externalities costs were rather unknown, and
- The price of raw materials and oil had a medium impact on both the final costs of products and services, and innovation towards resources efficiency.

When considering the full value chain,

[4] Answers received from Lower Silesia only.

- Most companies believed that the adoption of CE strategies did not depend upon their position within it.
- It was not clear whether cooperation within the value chain would contribute to the development of a CE.
- There was no consensus on the level of influence on suppliers.

There was not a clear idea among respondents on how to create a business ecosystem to accelerate the transition to CE, as each region identified various and very different aspects.

Business

The level of CE integration within hierarchical levels was considered to be medium in BCs. With regards to the structure needed to integrate CE issues within companies, there was a general consensus that:

- It should be led from high hierarchical levels, such as directors or senior management.
- It was the responsibility of: a) **several departments in the case of BCs** (such as production, research and development, purchasing and marketing) and b) one department in SMEs.

Respondents from this sector believed that sharing information among companies was difficult. Instead, there was no consensus on the degree of difficulty to share information among departments of the same company.

To improve transparency, respondents suggested tools such as proper procedures and communication chains.

Imperfect information and **additional costs arose as two important barriers' subtype**. Regarding administrative burdens and transaction costs:

- Administrative burden referred, primarily, to monitoring and reporting.
- Legal obligation was the most important transaction cost.
- Proper regulation, standardization and development of guidelines were seen as two possible actions to reduce these costs.

Technology

In general, **neither internal nor external skilled** professionals seemed to be a matter of concern. As per the answers received, technology was not considered as an issue taken into account in this sector.

Education and training were seen as the main mechanism to decrease the gap between technology development and business.

Other aspects highlighted as potential barriers to the development of a CE were "*social mindsets' versus a continuous economic growth model*" and incoherences between EU and national legislations.

SECTOR Business size		BIOMASS		RAW MATERIAL		BUILT ENV		FOOD WASTE		PLASTICS		TEXTILE		WEEE		TOURISM
		SMEs	BCs	SMEs	BCs	SMEs	BCs	SMEs	BCs	SMEs	BCs	SMEs	BCs	SMEs	BCs	SMEs
ECONOMIC	PROFIT															
	CAPITAL															
	COSTS															
REGULATORY FAILURES	REGULATORY FRAMEWORKS															
	GOVERNMENT SUPPORT															
SOCIAL FACTORS	INTERNAL BUSINESS CULTURE															
	CUSTOMERS AND SOCIETY															
	EXTERNALITIES															

SECTOR Business size		BIOMASS		RAW MATERIAL		BUILT ENV		FOOD WASTE		PLASTICS		TEXTILE		WEEE		TOURISM
		SMEs	BCs	SMEs	BCs	SMEs	BCs	SMEs	BCs	SMEs	BCs	SMEs	BCs	SMEs	BCs	SMEs
MARKET FAILURES																
	BUSINESS ECOSYSTEM															
BUSINESS	GOVERNANCE															
	ADDITIONAL COSTS															
TECHNOLOGY + KNOWLEDGE	ACCESSIBILITY															
	SKILLS															

Table 4: Most relevant barriers for the different sectors and business size

5. Regional analysis

The regional analysis aims to highlight the main barriers to the development of a CE in each of the regions involved in the study and to capture its particularities.

5.1. LOMBARDY

Lombardy is one of the regions that perceived a higher level of Circular Economy inclusion, as in most sectors it was scored above 7.

Although CE was mainly seen as profitable, there is a general perception that it incurs in **additional economic and non-economic costs**. Incentives (such as tax policies, green procurement or financial support), regulatory frameworks and the development of EU standards were some of the tools suggested to increase profit.

The region has responsibilities in CE and various national legislations in place –eg: waste management plan, a law concerning mining activities, and regulations on plastics and traceability- that directly or indirectly tackle CE. However, the high divergence in the answers related to the effectiveness, influence and description of these regulatory frameworks seems to indicate that they affect differently each of the sectors. Incoherences between incentives for recycling and authorizations for using secondary raw materials, and the impossibility, by law, of using recycled aggregates were mentioned. Most companies claimed for a simplification of the regulatory frameworks and procedures, the harmonisation of waste management legislation, and the inclusion of monitoring systems. Government support and leadership was important from an SME's point of view.

Although Lombardia showed a rather good inclusion of sustainability as a business strategy, **social factors were considered to affect the growth of a CE**. Companies believed that the adoption of green strategies depended on managers' attitudes. Likewise, the demand for green products depended on the level of public information and awareness. Therefore, any communication initiative to raise awareness and understanding was seen as positive.

Creating a business ecosystem was perceived as determinant for the development of a CE, yet an opportunity for businesses and a better environment to shift to green supply chains. However, this implies sharing information among and within companies, which was often regarded as difficult. Some tools proposed to boost the creation of these ecosystems were digital platforms, business associations or networking initiatives.

5.2. GELDERLAND

Gelderland perceived the inclusion of Circular Economy within their region as medium to low.

Companies in the region appointed economic barriers as influential to the development of a CE. Most of them, but particularly SMEs, perceived CE as not profitable enough, because they believed it incurred in additional economic and non-economic costs and it was capital intensive. Moreover, there was a sense of uncertainty and lack of understanding around the benefits and returns from CE investments that could discourage companies and funders. Public financing to reduce such risks is considered to be helpful because

it would imply sharing the capital risk among companies (regular business risks) and the society (additional circular investment costs).

The region has responsibilities in CE and a national legislation that directly or indirectly tackles CE. However, these regulatory frameworks seem to affect differently each of the sectors.

Companies in Gelderland perceived the level of inclusion of sustainability as a business strategy as medium to low. They believed that the adoption of green strategies depended upon business managers' attitude and their understanding of CE concepts, which were regarded as medium. At social level, the **low demand for green products and customers' unwillingness to shift from product to service,** were appointed as the most important barriers to the development of a CE. Communication and VAT reduction for circular products are proposed as tools to raise the demand for these products.

Sharing information among companies and **split incentives** were identified as other hindrances to the development of a CE in this region.

From a technological point of view, SMEs stated that they were not fully aware of technological improvements. As potential solutions to this gap, they proposed knowledge transfer through active and structural traineeship programmes addressed to SMEs, educational organisations and public knowledge institutes, and awareness raising.

5.3. LOWER SILESIA

Lower Silesia perceives the inclusion of Circular Economy in the region as low.

The region responded the questionnaires for three sectors: Biomass, Food Waste and Raw materials. Since the answers given in each sector were identical, this analysis could not identify any possible differences among sectors. However, some interesting results emerged from both SMEs and BCs.

SMEs and Big corporations showed a clear different perception on the profitability of CE. While SMEs believed that it was not profitable because the pay-back period was too long (more than 5 years) and the returns from innovation on CE were not acceptable, big corporations observed the opposite. However, both agreed that CE integration implied changes in production, technology and materials; R&D investment; staff training; and adaptation to new regulations. These changes, besides being capital intensive, were also considered to entail some additional economic and non-economic costs. Respondents proposed many policy tools to increase profit, such as EU or National funding, low taxes, economic incentives for recycled and remanufactured products, or the withdrawal of environmentally harmful subsidies, the use of which reduces the competitiveness of technologies and environmentally friendly solutions.

The region does have neither responsibilities nor regulatory frameworks in place on CE, so CE is ruled by national programmes. Companies agreed that national targets and objectives to develop a CE were not clearly defined. Respondents did not identify any policy incoherencies. In the absence of effective legislative mechanisms to impel the transition to sustainability, companies believed that it could be fostered by customers' pressure, labels and foreign companies.

Again SMEs and Big corporations showed different perceptions on the level of integration of sustainability as a business strategy and the demand for green products. They were perceived as low in SMEs and medium in BCs. In order to improve the level of CE understanding among managers and company work forces,

respondents proposed awareness campaigns to show financial benefits, good practices, guides and consultation points to facilitate CE implementation, support for entrepreneurs, etc. To tackle citizens' interest, they proposed to run awareness campaigns on eco-labelling and sustainable development, or collaborating with church and NGOs.

Surprisingly, companies in Lower Silesia did not think collaboration and cooperation among businesses were necessary to develop a Circular Economy, although big corporations agreed that they could influence their suppliers as a means to condition the shift to 'green supply chains'.

5.4. SLOVENIA (SOS)

Analysis done under chapter 4.7 Tourism.

5.5. London (LWARB)

Few conclusions could be withdrawn from this region as most of the questions of the questionnaire were not answered and, in many cases sectorial responses were identical. Nevertheless, some of the observations included in the questionnaire are worthwile mentioning here.

London has a newly published a Circular Economy route map to drive the transition to a CE. This region has the perception that the integration of CE practices can be profitable in spite of initial capital outlay needed to set up new business practices such as equipment, training, etc.

Tools to support this transition include financial incentives, specific taxation, business advice, support for innovation and new technology, clear demonstration of CE concept and business case, opportunity to network, public procurement specifications which incorporate CE, targets for reuse of materials, statutory CE targets, policy to drive behaviour change, and policy harmonisation .

The demand for green products in London region is perceived as medium to low, depending on the sector, and it is stated that it could be increased through consumer behaviour campaigns. Final delivery costs are perceived to be highly dependent upon the price of raw materials and oil.

Business ecosystems are considered to be crucial to establish a CE. Some of the tools proposed to boost these ecosystems are: provision of space and logistics, planning, reuse and recycling policies, legislative frameworks which do not protect non CE aims, promotion and support of voluntary agreements and best practice, or the design of new business models.

5.6. SOFIA

In this region, two municipal enterprises and one SME answered the questionnaires. The level of circular economy integration was perceived as low.

Most companies believed that the integration of CE brought measurable benefits, with a medium pay-back period for innovation. It was pointed out that the integration of CE measures could be increased by introducing changes in the national legislation, investing in awareness campaigns and education programs, or setting up collaborative platforms.

It is interesting to notice that in this region some sectors did not perceive CE integration as capital intensive, nor that it required upfront investments.

It was not clear for respondents whether Sofia region had responsibilities on circular economy. In this line, the answers obtained suggest that this region does not have a) any regulatory frameworks on CE in place, neither at national nor at regional level, nor b) any clear national targets and objectives to develop a CE. However, it was stated that the Government should lead the transition towards CE and that, to do so, it should put in place economic, financial and tax incentives.

Companies in Sofia mentioned having integrated sustainability as a business strategy. Sustainability improvements were perceived to be led by internal environmental policies (such as the Waste Management Act), leadership and economic profit.

CE understanding among staff and managers was observed as medium. At social level, both the **low acceptance of second hand products** and the **low demand for green products** were seen as the main barriers to transit towards a full implementation of a CE. It is emphasized that, probably, there is not enough information on social and environmental impacts of products and services, nor enough information and awareness on sustainability and CE.

All companies involved in the study believed that collaboration among businesses within the value chain was determinant to develop a CE and, at the same time, a business opportunity. To develop such circular ecosystem, respondents highlighted the need to improve communication and to establish networking platforms.

Finally, it is worth mentioning that respondents pointed out that the lack of professionals on CE could become an issue in Sofia unless suitable formal and non-formal education is provided (trainings, workshops or educational programmes).

5.7. Hauts-de-France

Likewise Lombardia, Hauts-de France perceived a high level of CE integration.

The region responded the questionnaires for two sectors: plastics and textile. Since the answers given for both sectors were identical, this analysis could not identify any possible differences among sectors. However, some interesting results emerged from the answers obtained.

In general terms, respondents from Hauts-de-France perceived CE as capital intensive but profitable, with medium-term acceptable return pay back from innovation. European regulations and public procurement, as well as better funding, were proposed to help increasing profit and providing support for the inclusion of CE.

The region has a new regional waste management strategy that includes circular economy. Companies in the region felt that national targets and objectives to develop a CE were clearly defined and that the government should have a leadership role in the transition towards a CE. It is the only region that believes

that sustainability improvements are driven by people's understanding that the linear model was coming to an end.

Companies in the region considered that the adoption of green strategies highly depended upon managers' attitude. However, they pointed out that manager's understanding of CE was medium and that it could be increased through training, consulting, exchange of examples and best practices. They observed the level sustainability integration as a business strategy as medium.

The demand for green products in the region was perceived as medium, and it was stated that it could be boosted by increasing awareness. Nevertheless, there was the opinion that customers' consumption culture was still not ready to shift from product to service, neither to use second hand products.

In order to facilitate the implementation of CE there was the general feeling that collaboration among companies and within departments of the same company was important and determinant. However, respondents stated that sharing information was still difficult, as trust and confidence had to be built up.

It is interesting to notice that companies in Hauts-de-France thought that CE had to be embedded as a business strategic objective which had to be implemented from managerial positions.

In order to increase transparency, companies in the region referred to the use of life cycle analysis or product environmental footprint as a means to show the impact of products/services on the environment as well as to the importance of raising awareness.

In the region companies felt rather unaware of technological innovations and mentioned employees skills as a difficulty to adopt CE strategies.

5.8. Catalonia

The level of circular economy integration was perceived as medium to low depending on the sector.

In Catalonia the economic burden of CE integration was perceived as an important barrier. Although acknowledging the profitability of CE integration, companies in the region declared that the inclusion of circular innovations was capital intensive in terms of up-front investments and other extra costs (financial and non-financial) that often had a non-acceptable repayment period. It was pointed out that public initiatives to support research and innovation or the introduction of financial benefits and incentives could well reduce the amortization periods which would make CE innovation more attractive.

Another interesting aspect was the fact that companies did not link specific existing regulations on the environment, resources and waste or waste water treatment with circular economy. In consequence, they sensed a lack of regulatory frameworks regarding circular economy, and so, a lack of clear national targets and objectives (in spite of the fact that Catalonia approved the strategy "Boosting Circular Economy in Catalonia" in 2015). However, they believed that not only governmental leadership is needed, but also changes in consumers' demands, more internal business leadership or the setting of internal business strategic targets.

Concerning regulatory failures, it is also remarkable to note that companies identified several aspects regarding specific pieces of legislation, either being European, national (N) or regional (R), as barriers to the development of a CE in Catalonia[5]:

- Definition of by-product according to *Decret 93/1999* on the procedures for waste management (R)[6].
- Management requirements for certain by-products according to *Ordre ARP/354/2016* that regulates the elimination of by-products from vinification (R).
- Some requirements regarding the agro-food sector according to *Real Decreto 1620/2007* on the reuse of treated wastewater (N).
- Some safety requirements regarding the transport of goods of the Directive 2014/47/UE on the technical roadside inspection of the roadworthiness of commercial vehicles circulating in the Union might hinder some packaging reduction strategies.

Once again, social factors related to both business and social culture were identified as important barriers for the development of a CE. Lack of understanding of CE concepts, low awareness on sustainability, low demand for green products and customers' low cost culture and preference for new products were aspects that were considered to hinder the implementation of a circular economy.

Unlike most other regions, Catalonia perceived the globalisation of the value chain as an important barrier to the development of a CE. Probably because it hinders the establishment of proper collaboration relationships among businesses within the value chain, which was an aspect that they valued as determinant to develop a CE. Difficulties with regards to sharing information among companies were perceived as another barrier to set up a proper circular ecosystem.

Clear certification schemes (simple, clear, uniform...), proper labelling systems (ecotex, global recycled system...), digital platforms for valorisation of waste, traceability or communication with representatives of the entire value chain, and reverse logistic schemes were proposed tools and infrastructures to enhance the transition to a CE.

[5] Apart from the pieces of legislation listed below, other incoherencies were mentioned with regards to some sector-level regulations such as the Regulations on "Designations of Origin" or some of the requirements to obtain organic farming certifications (which might both hinder the implementation of some CE options).

[6] Awaiting for the development of *Ley 22/2011* on waste and polluted soils (N).

6. Final conclusions

Developing a circular economy implies a change in the mindsets of both society and businesses. It means creating a new socio-economic model, where linear production and consumption patterns are left behind and substituted by circular recipes. Incremental changes are needed but also disruptive and radical innovation. Therefore, to be effective and successful, such a change requires economic resources and leadership. The results from this study are coherent with this statement, as costs and culture are the main barriers to the development of a CE that have been identified.

Costs include upfront investments (capital), financial costs and non-financial costs. Culture refers to abilities and attitudes required at all levels to build a new reality. In this sense, culture relates not only to social attitudes to consumption –preference for new products, low-cost culture,…- but also to prejudices and fears towards sharing information, transparency and collaboration among businesses, that are all fundamental to create a proper business ecosystem. Last but not least, it also refers to the institutional conviction and determination to lead and support this change. In fact, most respondents believed that while CE integration in the business world depended upon the attitudes and leadership of company managers (or owners), which had the responsibility to trickle down the inclusion of CE among most departments; governments should lead the transition at national level.

Other potential barriers analyzed in the study, such as externalities, technology, skills and regulatory frameworks could be understood as mere tools to support the transition. In that sense, these aspects that are currently observed as potential hinderers, if properly adjusted and used, could play an important role to enhance and assist the transition to a CE by setting up the required environment –legal, technological, market - to move on.

These results match with other studies' conclusions that also identified social and business attitudes, financial needs and institutional deficiencies as the main barriers to a full deployment of CE. We can conclude that the barriers identified in this study are the same or similar to the barriers in the literature: financial, structural, operational, attitudinal and technological.

It is of mention a sense of misunderstanding of the concept 'externalities', which we believe is critical to properly assess the costs/gains of introducing CE initiatives.

Some general differences between SMEs and Big corporations can be withdrawn. Big Corporations have the size and economic power to move on, hence their dependence on capital, regulatory frameworks or government support is lower than SMEs. Instead, their internal structure is complex and large, which makes it less apt for sharing information, and triggering down managerial decisions on CE.

BARRIER	BARRIER SUBTYPE	H	H-M	M	M-L	L
ECONOMIC	PROFIT					■
	CAPITAL	■				
	COSTS	■				
REGULATORY FAILURES	REGULATORY FRAMEWORKS				■	■
	GOVERNMENT SUPPORT	■	■			
SOCIAL FACTORS	INTERNAL BUSINESS CULTURE	■	■			■
	CUSTOMERS AND SOCIETY	■				
MARKET FAILURES	EXTERNALITIES		■	■		
	BUSINESS ECOSYSTEM	■	■			

BUSINESS	GOVERNANCE					
	ADDITIONAL COSTS					
TECHNOLOGY + KNOWLEDGE	ACCESSIBILITY					
	SKILLS					

Table 5: Most and least important barriers to the development of a circular economy

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Annex 1 - Barriers' Analysis from CircE Tool

a. Rationale and objective of the analysis

During second and third semester of the project Circe, partners have gathered opportunities on circular economy for their territories and for their sectors of interest. The description of each opportunity followed a common framework, "CircE Tool". This tool included a section to report the different types of barriers that need to be tackled to "turn the opportunity into a reality".

The present report gives an overview of the barriers detected across the target sectors and within a region. Specifically, it provides information concerning different types of barriers, the main barriers among sector opportunities and the predominant type of barrier listed by each region.

b. Methodology of Analysis

Information included in Step 6 "Barriers and Policy Interventions" of the CircE Tool was used. A total of 224 barriers were reported corresponding to 103 circular opportunities. Barriers were ranked per sector and per region.

The Barrier groups taken into account in the CircE Tool were:

- Economic- financial aspects.
- Market failures- aspects that the current market has not been able to regulate.
- Regulatory failures- legislation and government support.
- Social factors- social acceptance and attitudes.
- Technological - access to technology and demand for new skills.
- Business structure- businesses organization and governance issues.
- Other

c. Results and discussion

A barriers' analysis per sector is carried out and gives an overview of the barriers that are more and less relevant for the sector. Figure 1 shows the results for the 9 sectors studied: building, plastics, food, textile, WEEE-strategic materials, tourism, biomass, mobility and raw materials, and cross-sectorial opportunities.

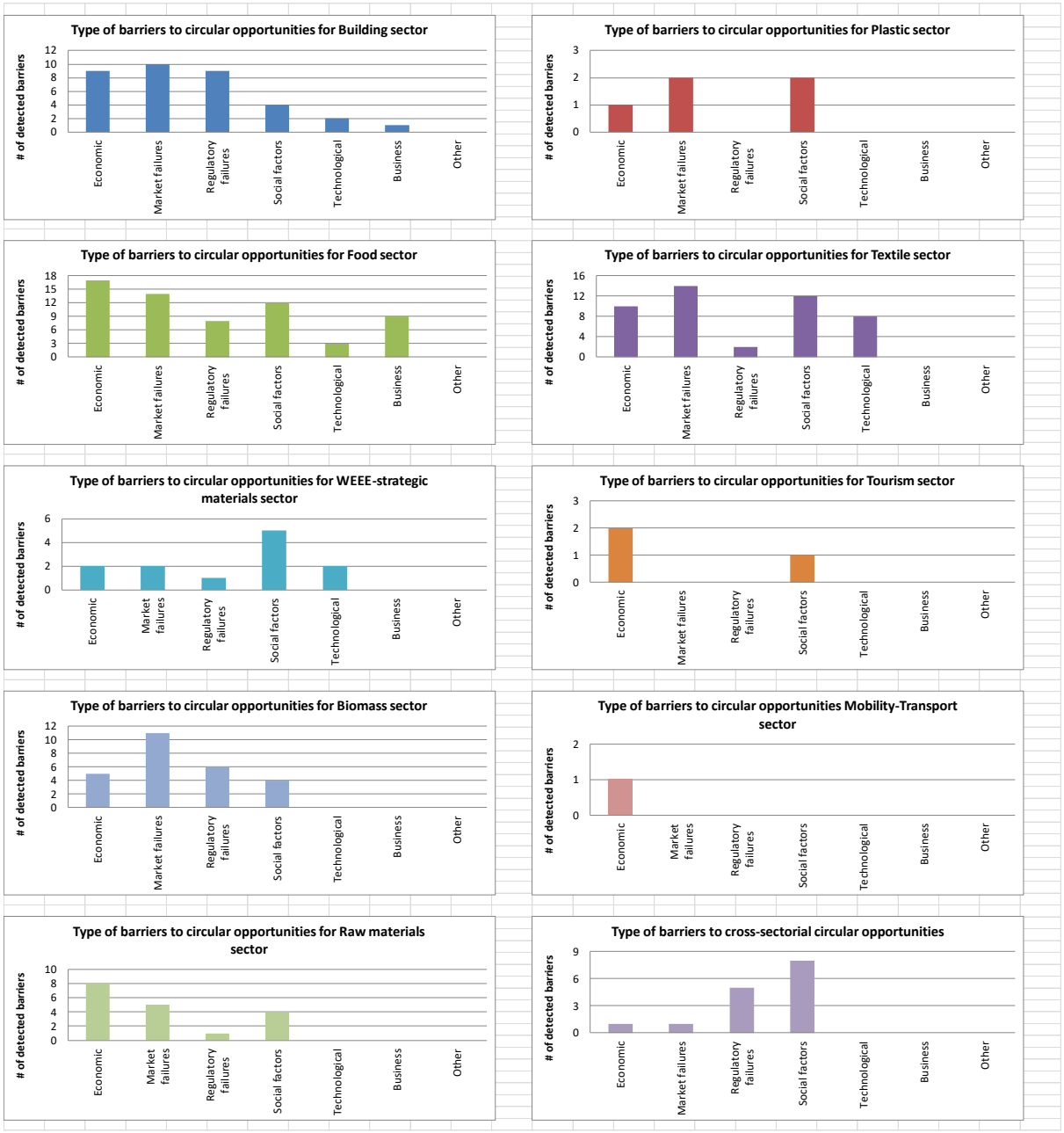

Figure 1. Number of detected barriers per sector. Relevance of the different types barriers.

Barriers related to **economic factors and market failures** were predominant in all sectors except WEEE-strategic materials and cross-sectorial opportunites, in where social factors were the main barriers detected. **Social factors** are also a significant type of barrier for the plastics sector, food, textile and tourism. **Technological barriers** are reported as important specially in the textile sector. Building, food and biomass sectors present a significant proportion of barriers coming from regulatory failures.

A second analysis is carried out to study the types of barriers that are more and less reported for the specific opportunities that each region has identified. Figure 2 shows the number and type of barriers identified for the opportunities in each region.

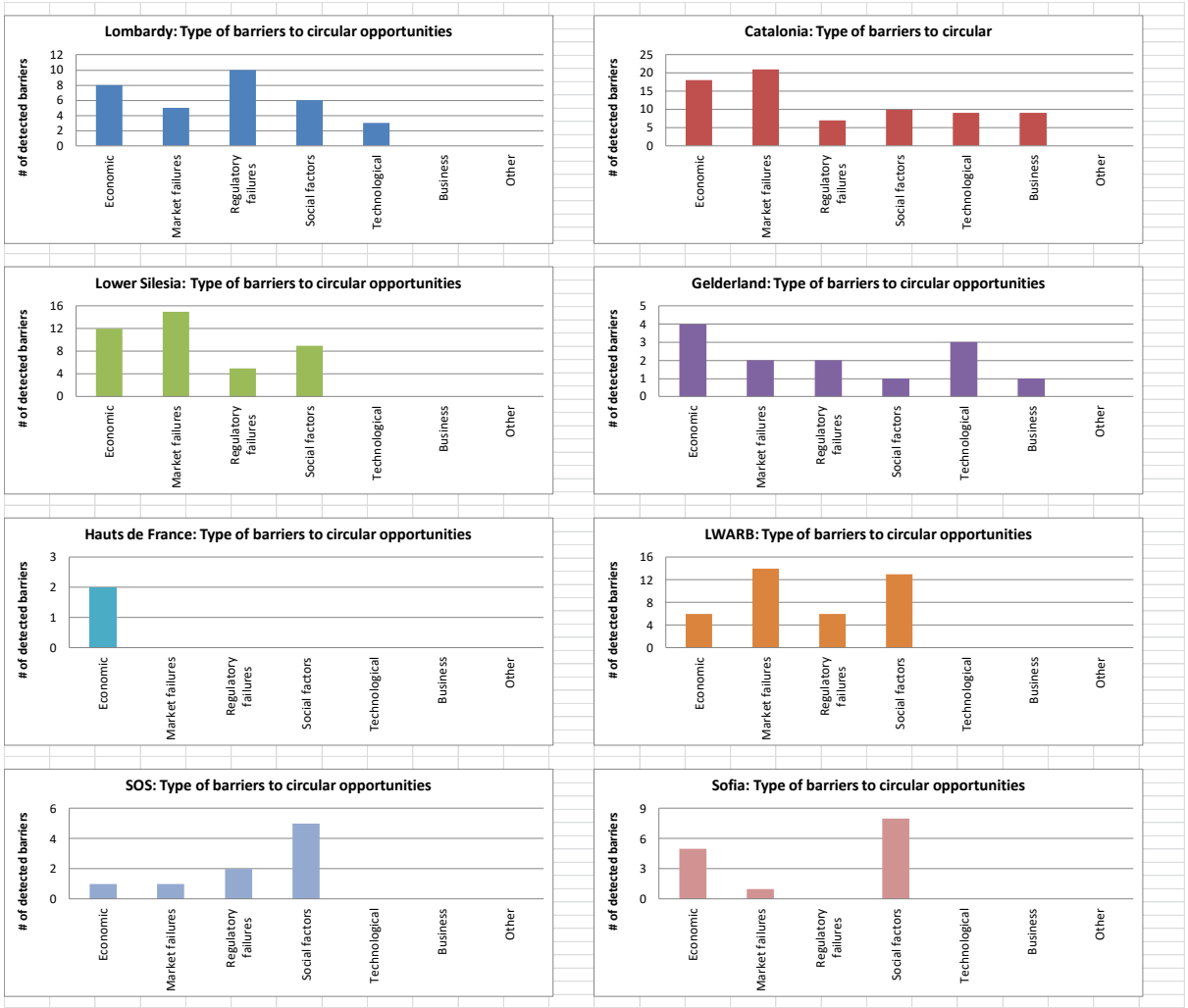

Figure 2. Number of detected barriers reported by all the circular opportunities from a region. Relevance of the different types barriers.

Lombardy reported a significant amount of barriers coming from regulatory failures and economic aspects, followed by social factors and market failures ones. **Catalonia** and **Lower Silesia** show a high predominance of barriers related to economic and market failure aspects. **Gelderland** reported a high amount of barrieres related to economic and technological aspects. **Hauts de France** reported only economic barriers that influence the deployment of the reported opportunities. The barriers reported by **LWARB** were mainly dealing with market failure and social factors. **SOS** and **SOFIA** showed a significant amount of barriers related to social factors in comparison with the other types.

Annex 2 – Questionnaire

PROJECT PARTNER: i)	LP LOMBARDIA	PP2 CATALONIA	PP3 LOWER SILESIA
SELECT SECTOR: ii)	BUILT ENVIRONMENT	PLASTICS	FOOD WASTE

BARRIERS				TYPE OF ANSWERS IN RELATION TO SMEs	TYPE OF ANSWERS IN RELATION TO BIG CORP
			1 What is the level of Circular Economy (CE) integration perceived in your region?	FROM 1 (nonexistent) TO 10 (totally implemented)	FROM 1 (nonexistent) TO 10 (totally implemented)
ECONOMIC	PROFIT	2 Rate **'lack of/low profits'** as a barrier to the development of a CE in your region		NOT RELEVANT - IMPORTANT - VERY IMPORTANT	NOT RELEVANT - IMPORTANT - VERY IMPORTANT
	CAPITAL	3 Rate **'difficulties to access to capital'** as a barrier to the development of a CE in your region		NOT RELEVANT - IMPORTANT - VERY IMPORTANT	NOT RELEVANT - IMPORTANT - VERY IMPORTANT
	COSTS	4 Rate **'costs'** as a barrier to the development of a CE in your region		NOT RELEVANT - IMPORTANT - VERY IMPORTANT	NOT RELEVANT - IMPORTANT - VERY IMPORTANT
REGULATORY FAILURES	REGULATORY	5 Rate **'inadequate legal frameworks'** as a barrier to the development of a CE in your region		NOT RELEVANT - IMPORTANT - VERY IMPORTANT	NOT RELEVANT - IMPORTANT - VERY IMPORTANT
	GOVERNMENT SUPPORT	6 Rate **'lack of/ low government support'** as a barrier to the development of a CE in your region		NOT RELEVANT - IMPORTANT - VERY IMPORTANT	NOT RELEVANT - IMPORTANT - VERY IMPORTANT
		7 Rate **"insufficient public goods/infrastructure provided by State"** as a barrier to the development of CE in		NOT RELEVANT - IMPORTANT - VERY IMPORTANT	NOT RELEVANT - IMPORTANT - VERY IMPORTANT
SOCIAL FACTORS	INTERNAL BUSINESS CULTURE	8 Rate **' business attitudes towards green business'** and **'mental frames at management and opperational levels'** as a barrier to the development of a CE in your region		NOT RELEVANT - IMPORTANT - VERY IMPORTANT	NOT RELEVANT - IMPORTANT - VERY IMPORTANT
		9 Rate **'complexity of both CE concept and implementation'** as a barrier to the development of CE in your region		NOT RELEVANT - IMPORTANT - VERY IMPORTANT	NOT RELEVANT - IMPORTANT - VERY IMPORTANT
	CUSTOMERS AND SOCIETY	10 Rate **'customers' attitudes and values'** as a barrier to the development of a CE in your region		NOT RELEVANT - IMPORTANT - VERY IMPORTANT	NOT RELEVANT - IMPORTANT - VERY IMPORTANT
MARKET FAILURES	EXTERNALITIES	11 Rate **'lack of internalisation of externalities'** as a barrier to the development of a CE in your region		NOT RELEVANT - IMPORTANT - VERY IMPORTANT	NOT RELEVANT - IMPORTANT - VERY IMPORTANT
	BUSINESS COMPETITION	12 Rate **'competition with business as usual'** as a barrier to the development of CE in your region		NOT RELEVANT - IMPORTANT - VERY IMPORTANT	NOT RELEVANT - IMPORTANT - VERY IMPORTANT
	BUSINESS ECOSYSTEM	13 Rate **'insufficient circularity integration in the supply chain'** as a barrier to the development of CE in your region		NOT RELEVANT - IMPORTANT - VERY IMPORTANT	NOT RELEVANT - IMPORTANT - VERY IMPORTANT
		14 Rate **"insufficient public goods/infrastructure provided by the market"** as a barrier to the development of CE in your region		NOT RELEVANT - IMPORTANT - VERY IMPORTANT	NOT RELEVANT - IMPORTANT - VERY IMPORTANT
BUSINESS STRUCTURE	GOVERNANCE	15 Rate **'low internal common view on sustainability'** as a barrier to the adoption of CE strategies in companies in your region		NOT RELEVANT - IMPORTANT - VERY IMPORTANT	NOT RELEVANT - IMPORTANT - VERY IMPORTANT
		16 Rate **'demand for transparency'** as a barrier to the development of CE in your region		NOT RELEVANT - IMPORTANT - VERY IMPORTANT	NOT RELEVANT - IMPORTANT - VERY IMPORTANT
	ADDITIONAL COSTS	17 Rate **'additional administrative burden'** as a barrier to the development of CE in your region		NOT RELEVANT - IMPORTANT - VERY IMPORTANT	NOT RELEVANT - IMPORTANT - VERY IMPORTANT
		18 Rate **'additional transaction costs'** as a barrier to the development of CE in your region		NOT RELEVANT - IMPORTANT - VERY IMPORTANT	NOT RELEVANT - IMPORTANT - VERY IMPORTANT
TECHNOLOGY + KNOWLEDGE	ACCESSIBILITY	19 Rate **' difficult access to appropriate green technology'** as a barrier to the development of CE in your region		NOT RELEVANT - IMPORTANT - VERY IMPORTANT	NOT RELEVANT - IMPORTANT - VERY IMPORTANT
	SKILLS	20 Rate **'lack of skills and capabilities'** as a barrier to the development of a CE in your region		NOT RELEVANT - IMPORTANT - VERY IMPORTANT	NOT RELEVANT - IMPORTANT - VERY IMPORTANT

BARRIERS			TYPE OF ANSWERS	
			IN RELATION TO SMEs	IN RELATION TO BIG CORP
ECONOMIC	PROFIT	21 Do companies in your region think CE is profitable?	YES/NO/NA	YES/NO/NA
		22 Are companies in your region able to measure economic benefits (profitability) from introducing CE? If not, please explain why?	YES/NO/NA (text)	YES/NO/NA (text)
		23 Companies in your region think the pay-back period for innovation on CE is:	ACCEPTABLE (<2 y) - MEDIUM (2-5y)- NON ACCEPTABLE (>5y) / NA	ACCEPTABLE (<2 y) - MEDIUM (2-5y)- NON ACCEPTABLE (>5y) / NA
		24 Companies in your region think the return from innovation on CE is:	ACCEPTABLE - MEDIUM - NON ACCEPTABLE / NA	ACCEPTABLE - MEDIUM - NON ACCEPTABLE / NA
		25 What kind of policy tools would contribute to increase profit so as to accelerate the transition to CE?	text	text
	CAPITAL	26 Do companies in your region think CE integration is capital intensive?	YES/NO/NA	YES/NO/NA
		27 What kind of actions do they refer to when stating that CE integration is capital intensive? (ex. Capital availability, investment capacity,...)	text	text
		28 Have companies in your region experienced difficulties to attract funding from banks? If yes, please explain why	YES/NO/NA (text)	YES/NO/NA (text)
		29 have companies in your region experienced difficulties to access other financial sources? please explain why		
		30 What kind of financial tools would contribute to overcome capital as barrier so as to accelerate the transition to CE?	text	text
	COSTS	31 Do companies in your region believe that CE integration will incur in additional costs?	YES/NO/NA	YES/NO/NA
		32 If so, could you explain what kind of extra costs?	text	text
		33 What kind of tools would be needed to reduce upfront and extra costs so as to accelerate the transition to CE?	text	text
REGULATORY FAILURES	REGULATORY FRAMEWORKS	34 Does your region have responsabilities (competences) in circular economy? If the answer is "Yes", please specify	YES/NO/NA (text)	YES/NO/NA (text)
		35 In your region, are there regulatory frameworks regarding circular economy in place? If the answer is "Yes", please specify. If your answer is "No", does it exist at national level? If the answer is "Yes", please specify.	YES/NO/NA (text)	YES/NO/NA (text)
		36 What is the level of regulatory influence local authorities have on the companies in your region?	LOW - MEDIUM - HIGH / NA	LOW - MEDIUM - HIGH / NA
		37 Are SMEs and Big corporations in your region differently influenced by such regulatory frameworks? If so, how?	YES/NO/NA (text)	YES/NO/NA (text)
		38 Companies in your region believe that the level of effectiveness of this legislation is:	LOW - MEDIUM - HIGH /NA	LOW - MEDIUM - HIGH /NA
		39 please, briefly justify your answer	text	text
		40 How effective is enforcement of this legislation in your region?	LOW - MEDIUM - HIGH / NA	LOW - MEDIUM - HIGH / NA
		41 In the absence of an effective enforcement mechanism, what drives sustainability improvements?	text	text
		42 According to companies in your region, what kind of regulatory support would be needed?	text	text
	GOVERNMENT SUPPORT	43 In your region, are there any policy framework or tools regarding circular economy?	YES/NO/NA (text)	YES/NO/NA (text)
		44 Do companies in your region feel that national targets and objectives to develop a CE in the region are clearly defined as to move industry towards it? If not, why?	YES/NO/NA (text)	YES/NO/NA (text)
		45 To what extent companies in your region believe that government should lead the transition to CE?	LOW - MEDIUM - HIGH / NA	LOW - MEDIUM - HIGH / NA
		46 What kind of lacking infrastructure should be provided by the State?	text	text
		47 Have companies in your region identified policy incoherences that may hinder CE integration?	YES/NO/NA	YES/NO/NA
		48 please, briefly explain them	text	text
		49 What kind of government incentives/support do companies require to accelerate the transition to CE?	text	text
SOCIAL FACTORS	INTERNAL BUSINESS CULTURE	50 To what extent adoption of green strategies within companies in your region depend upon business managers' attitude to green business / sustainability?	LOW - MEDIUM - HIGH / NA	LOW - MEDIUM - HIGH / NA
		51 To what extent managers and staff from companies in your region properly understand CE concepts?	LOW - MEDIUM - HIGH / NA	LOW - MEDIUM - HIGH / NA
		52 To what extent companies in your region have integrated sustainability as a business strategy?	LOW - MEDIUM - HIGH / NA	LOW - MEDIUM - HIGH / NA
		53 What kind of actions would lead to a better understanding and implementation of CE in companies?	text	text
	CUSTOMERS AND SOCIETY	54 Select three aspects of social behaviour that companies in your region may view as the main barriers to the social acceptance of a CE	sense of convenience, low cost culture, consumption culture, others	sense of property/ownership, preference of new vs second hand,
		55 Do companies in your region think the demand for green products is:	LOW - MEDIUM - HIGH / NA	LOW - MEDIUM - HIGH / NA
		56 Do companies in your region believe that more information and awareness on sustainability and CE would shift the demand for green products?	YES/NO/NA	YES/NO/NA
		57 Do products in your region display sufficient information on social and environmental impacts?	YES/NO/NA	YES/NO/NA
		58 To what extent customers in your region are ready to shift from product to service?	LOW - MEDIUM - HIGH / NA	LOW - MEDIUM - HIGH / NA
		59 What kind of actions would contribute to encourage citizens to accelerate the transition to CE?	text	text
MARKET FAILURES	EXTERNALITIES	60 To what extent companies in your region know the costs of externalities in the products or services they sell?	LOW - MEDIUM - HIGH / NA	LOW - MEDIUM - HIGH / NA
		61 To what extent companies in your region include these costs in the final price of the products or services provided?	LOW - MEDIUM - HIGH / NA	LOW - MEDIUM - HIGH / NA

		62 To what extent final production/service delivery costs depend upon the price of raw material and/or oil?	LOW - MEDIUM - HIGH / NA	LOW - MEDIUM - HIGH / NA
		63 To what extent resources price affect innovation towards resource efficiency and CE?	LOW - MEDIUM - HIGH / NA	LOW - MEDIUM - HIGH / NA
		64 Do current regulatory frameworks in your region take into account the internalization of externalities?	YES/NO/NA	YES/NO/NA
		65 What kind of policy tools would contribute to overcome this barrier so as to accelerate the transition to CE?	text	text
	BUSINESS ECOSYSTEM	66 Do companies in your region value cooperation and collaboration among businesses within the value chain as an opportunity?	YES/NO/NA	YES/NO/NA
		67 Do companies in your region believe that their position/role in the value chain determines their adoption of CE strategies? If so, please explain why.	YES/NO/NA (text)	YES/NO/NA (text)
		68 Do companies in your region believe that collaboration among businesses within the value chain is determinant to develop a CE?	YES/NO/NA	YES/NO/NA
		69 To what extent the globalisation of value chains is a barrier to the development of CE?	LOW - MEDIUM - HIGH / NA	LOW - MEDIUM - HIGH / NA
		70 What level of influence on suppliers do the companies in your region have?	LOW - MEDIUM - HIGH / NA	LOW - MEDIUM - HIGH / NA
		71 Does such influence condition the shift to 'green supply chains'?	YES/NO/NA	YES/NO/NA
		72 What kind of lacking infrastructure should be provided by the market?	text	text
		73 What would be needed both at government and business levels to create a business ecosystem able to accelerate the transition to CE?	text	text
	BUSINESS GOVERNANCE	74 Do companies in your region believe that the level of CE integrationwithin hierarchical levels is:	LOW - MEDIUM - HIGH / NA	LOW - MEDIUM - HIGH / NA
		75 According to companies in your region, which managerial level needs to have the lead to implement CE?	YES/NO/NA (text)	YES/NO/NA (text)
		76 Do companies in your region think CE integration is the responsability of:	one Department / several departments / NA	one Department / several departments / NA
		77 Please specify which departament/s	production, research&development, purchasing, marketing, human resource management, accounting and finance, other (specify)	
		78 What kind of internal organization structure would help the integration of CE within companies?	text	text
		79 Companies in your region think that sharing information between companies is:	difficult/ easy / NA	difficult/ easy / NA
		80 Companies in your region think that sharing information between departments within the company is:	difficult/ easy / NA	difficult/ easy / NA
		81 please, briefly justify your answers	text	text
		82 What kind of policy tools would contributeto improve transparency between companies so as to accelerate the transition to CE? And between companies and society?	text	text
		83 According to companies in your region, do split incentives prevent or hinder the implementation of CE?	YES/NO/NA	YES/NO/NA
		84 According to companies in your region, do imperfect information, for exemple asymmetric or high cost information, exist that negatively affects market decisions?	YES/NO/NA	YES/NO/NA
		85 Which type of action would help to improve governance so as to accelerate the transition to CE?	text	text
	ADDITIONAL COSTS	86 Do companies in your region believe that there are additional internal costs (non financial) to the integration of CE?	YES/NO/NA	YES/NO/NA
		87 Select the three major types of administrative burdens related tothe integration of CE mentioned by companies in your region	monitoring and reporting, communication, reporting in different formats for each administration, meeting standards and legal obligations, certifications and labels procedures, specific knowledge and skills, others (specify)	
		88 Select the three major types of transaction costs related tothe integration of CE mentioned by companies in your region	search for information, bargaining costs, legal obligations, policy and enforcement, fees and charges, others (specify)	
		89 How would it be possible to reduce both administrative and transactions costs so as to accelerate the transition to CE?	text	text
TECHNOLOGY + KNOWLEDGE	ACCESSIBILITY	90 Select the three major technological aspects that are less accessible/developed:	good quality of recycled material, advanced green technologies, eco-designed products, technical know-how, legal incentives for R&D, economic incentives for R&D, cost effectiveness, quality of final redesigned products, innovation, others (specify)	
		91 Do companies in your region think that they are fully and permanently aware of existing technological innovations ?	YES/NO/NA	YES/NO/NA
		92 What kind of mechanisms would decrease the gap between technology development and businesses?	text	text
		93 What kind of incentives or support would contribute tocreate new and innovative technology so as to accelerate the transition to CE?	text	text
	SKILLS	94 Do companies in your region feel there is a lack of competent professionals onCE?	LOW - MEDIUM - HIGH / NA	LOW - MEDIUM - HIGH / NA
		95 Do companies in your region mention employees skills on CE as an additional difficulty to adopt CE strategies?	YES/NO/NA	YES/NO/NA
		96 Do educational curricula at all levels include issues regarding CE?	YES/NO/NA	YES/NO/NA
		97 What kind of government and/or business actions wouldhelp to develop the required professional skills so as to accelerate the transition to CE?	text	text
		98 Are there other potential barriers to CE not covered within the questionnaire? Please explain briefly	text	text