ULTIMATE

WATER SMART INDUSTRIAL SYMBIOSIS

D.4.1. Ethical Drivers & Societal Expectations for the Circular Economy

A white paper

Disclaimer: This deliverable has not yet been approved by the European Commission and should be seen as draft!

Author(s): Heidi Rapp Nilsen, Daniel Goodwin, Marine Poncet, Heather Smith, May Thorseth & Stef Koop

Date: 30/06/2021

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

Technical References

Project Acronym	ULTIMATE
Project Title	ULTIMATE: indUstry water-utiLiTy symbIosis for a sMarter wATer society
Project Coordinator	Gerard van den Berg KWR
Project Duration	01.06.2020 – 31.05.2024 (48 months)

Deliverable No.	D.4.1
Dissemination level [1]	PU
Work Package	WP4
Task	4.1
Lead beneficiary	NTNU
Contributing beneficiary(ies)	NTNU, UCRAN & KWR
Author(s)	Heidi Rapp Nilsen, Daniel Goodwin, Marine Poncet, Heather Smith, May Thorseth & Stef Koop
Quality Assurance	Stefania Munaretto (KWR), Sandra Casas (EUT)
Due date of deliverable	31/05/2021
Actual submission date	30/06/2021

[1] PU = Public
PP = Restricted to other programme participants (including the Commission Services)
RE = Restricted to a group specified by the consortium (including the Commission Services)
CO = Confidential, only for members of the consortium (including the Commission Services)

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

Document history

V	Date	Author(s) /Reviewer(s) (Beneficiary)	Description
0.1	24/06/2021	Stefania Munaretto (KWR	Quality Review
0.2	28/06/2021	Sandra Casas (EUT)	Final Quality check

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

Executive Summary

In this white paper, we dive into the moral and ethical drivers and motivations to adopt Circular Economy (CE) practices. What's more, we characterise the societal expectations and reflect on the level of influence that these societal expectations may have in adopting CE practices. We focus on a specific niche in the CE system - the role of water. Wastewater can be considered a largely untapped resource that can provide a major contribution to tackling challenges of water and resource scarcity, pollution and climate change while creating and maintaining vital services, economic growth and employment. More specifically, we consider the role of wastewater as a reusable resource and as a vector for energy and materials to be extracted, treated, stored and reused within an industrial context. This is 'Water Smart Industrial Symbiosis' (WSIS). The original title of the deliverable, as conceived in the grant agreement, "societal expectations and challenges around WSIS, and potential societal impacts of WSIS adoption" has been revised to make it more concise and to align it with the shift in emphasis towards moral and ethical drivers.

In this white paper, we examine two intertwined aspects of the transformation towards a CE:

(i) Moral and ethical drivers and motivations for companies to adopt CE practices (with a particular focus on examples of WSIS);
(ii) Societal expectations regarding the adoption of such CE practices.

Moral and ethical drivers are explored through the concepts of sustainability (within planetary boundaries), Corporate Social Responsibility (CSR) and Responsible Research and Innovation (RRI). State-of-the-art research is presented concerning environmental and social boundaries, what constitutes a sustainable CE, and ways to interpret and address societal expectations. Due to both environmental and societal challenges, the main takeaway is that a CE is not a synonym for sustainability. A sustainable CE requires an understanding of the interlinkages between global challenges and regional problems. This white paper reflects on ways to increase the sustainability of firms and projects working towards a CE with reference to both regional situations and the broader geographical sphere.

CSR is a commonly applied concept, often loosely used to express and legitimise corporate practices, ambition, and identity. Yet, to contribute towards achieving a CE, CSR ambitions and practices require transparent communication, not only focusing on contributions but also highlighting limitations to and ways of improving circularity. A more comprehensive analysis and transparent reporting of how different practices contribute to a CE is essential to avoid potential greenwashing practices. In this way, companies need to be prepared to be held accountable for their CE and sustainability claims. Beyond the benefits of enhancing CE innovations and practices, such a strategy may help contribute to a firm's positive public image in the long run. Hence, one can argue that it is in the interest of the firms as well as society as a whole that corporate communications are specific about CE goals, practices, and the methods of evaluating progress within their CSR strategy.

RRI implies that researchers, citizens, policymakers, business and third sector organizations work together throughout the research and innovation process to better

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

align both the process and its outcomes with the values, needs and expectations of society. RRI is compulsory in most projects financed by the EU's H2020, including the ULTIMATE project. This promotion of RRI and its guiding principles can therefore act as a moral driver for companies and research to invest in novel public engagement and governance aspects of CE systems, particularly as part of their innovation processes.

Partners in ULTIMATE and other CE projects recognise a moral obligation to contribute to a sustainable CE. Nevertheless, there are pitfalls on the path towards a sustainable CE. We highlight specific challenges and trade-offs that become evident when considering the CE within environmental and social boundaries, which are both under pressure. CE practitioners, and ULTIMATE partners and stakeholders, in particular, can contribute to more meaningful outcomes if they are aware of potential mismatches between sustainability and CE principles. In this respect, there are two key points to take into account:

- **A CE does not necessarily reduce the extraction of raw materials, the use of energy or the consumption of materials. Overcoming resource scarcity requires a more comprehensive set of ambitions;**
- **A CE that contributes to environmental sustainability, may reduce social sustainability. Such trade-offs can be better accounted for explicitly rather than implicitly.**

To enhance the sustainability of CE schemes, partners and firms have to consider these possible pitfalls and trade-offs. Through our investigation of CSR and RRI, we arrive at specific suggestions for reflection, which can be used to raise awareness on how to enhance the sustainability of a CE, by refining or modifying a project or an approach. Thus, the recommendations of this white paper can be exploited by the project partners, and outside ULTIMATE in relevant projects and policy spheres within the EU, as *ex ante*, intermediate and *ex post* assessment criteria for various CE initiatives, projects and programmes.

Alongside the conceptual discussions on moral and ethical drivers, this white paper presents the results of two national surveys undertaken in Spain and the United Kingdom (UK) where ULTIMATE demonstration cases are located. The surveys asked samples of the general public about their awareness of CE, social expectations for CE, alignment with four values perspectives and assessment of the legitimacy of CE systems. The surveys were supplemented by a small number of follow-up interviews in the UK. The results indicate that awareness of the CE terminology is limited among certain demographics (particularly older age groups in the UK), thus there are opportunities for improving awareness through tailored information and outreach campaigns. There is a general desire for companies to be both environmentally and socially responsible, which corresponds with the environmental and social values perspectives the majority of respondents were aligned with. The results also show a preference among many respondents for some level of government intervention in promoting the CE. However, although most respondents agreed with governments encouraging companies to adopt such systems, the level of agreement was less when it came to providing financial incentives, or for direct regulation. A willingness to pay more for circular products was moderate and, although there may be segments of the population that are willing to pay more, many will not (instead, perhaps, opting for lower

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

prices or convenience). These points add value beyond ULTIMATE, as actors wishing to advance CE initiatives in different regions of the EU can use these results to guide their own investigations into societal expectations.

When considering CSR through the lens of organisational and technological legitimacy, our surveys and in-depth interviews indicate that CE systems have higher moral legitimacy. This means that CE systems are judged as the right thing to do and are more aligned with the social values of the respondents. Generalised examples of CE schemes were also evaluated as having a degree of cognitive legitimacy, which means that some respondents comprehend the key goals, mechanisms and urgency. However, respondents were less likely to agree that CE systems provide a personal benefit that encourages them to be involved, thus pragmatic legitimacy is observed to be the lowest of the three forms considered. These results indicate promising opportunities to support the legitimisation of CE systems by further exploiting existing levels of moral and cognitive legitimacy as well as exploring avenues to cultivate pragmatic legitimacy to help people be more involved in CE practices. In this respect, outreach and involvement activities can make a significant difference.

Through investigating the social expectations for CE in two EU countries, we are able to extrapolate to an EU level and suggest that there is potential to support citizens' awareness of CE and WSIS concepts and to implement engagement strategies that will contribute to the broader legitimisation of CE. Furthermore, this document refers to specific EU policies and our recommendations may help the EU water sector in particular work towards these policy aims as well as contribute towards refining methods for how such policy aims can be met. For example, the Circular Economy Action Plan (European Commission, 2020a, ec.europa.eu/environment/circular-economy/) aims for co-creating outcomes with multiple stakeholders, to which we contribute a fuller understanding of the expectations of citizens and recommendations for building legitimacy. Moreover, building on our findings relating to ethical drivers and social expectations for the CE, novel governance or public engagement processes used in ULTIMATE may, in turn, help inform future developments of EU policy such as public engagement or governance dimensions of RRI (European Commission, 2021, ec.europa.eu/programmes/horizon2020/node/766).

In summary, the recommendations of this white paper have potential to be exploited by other workstreams and partners of the ULTIMATE project, as well as the wider landscape of organisations and policymakers looking to support the wider adoption of CE schemes in the EU (particularly relating to the water sector).
We argue that transformation towards a CE requires the establishment of WSIS. The process of putting WSIS into practice requires the development of new cognitive routines and technological trajectories (i.e. know-how) in the engineering community (core aim of WP1) and systematic technological and design interlinkages need to be established too (core aim of WP2). These interlinkages can be shaped by regulations and standards (task 4.2), new governance arrangements (task 4.3), but, perhaps primarily, by ambitions of both companies, policymakers and other stakeholders that are directly or indirectly involved. Hence, the moral-ethical drivers and societal expectations may form a focal point for innovative stakeholder engagement models in WP3, in particular for the business-to-business engagement in task 3.2, citizen

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

engagement in task 3.3 and their interaction in the Living Labs (task 3.4). Through these stakeholder engagement processes, the moral-ethical drivers and societal expectations outlined in this white paper may form – together with the demonstration of technical-symbiotic systems – one of the key considerations for meaningful interaction around WSIS demonstration cases.

Disclaimer

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

Table of Contents

1. INTRODUCTION AND OUTLINE 11

1.1. General introduction 11
1.2. Aim and scope 12
1.3. Linkages with other working packages and tasks 13
1.4. Reader's guide 13

2. PREMISE OF A CIRCULAR ECONOMY 15

2.1. From Linear to Circular Economy 15
2.2. A Sustainable Circular Economy 16
2.3. The hierarchy of resource use 19

3. CORPORATE SOCIAL RESPONSIBILITY 21

3.1. An introduction 21
3.2. Differences between regions 22
3.3. CSR as a driver for Circular Economy 22

4. RESPONSIBLE RESEARCH AND INNOVATION 24

4.1. An introduction 24
4.2. Relevant Policies to support RRI 25
4.3. RRI and Public engagement 26
4.4. RRI and Governance 27

5. SOCIETAL EXPECTATIONS AND LEGITIMISATION 29

5.1. Societal Legitimisation 29
5.1.1. Legitimacy framework 29
5.1.2. Legitimacy, CSR and RRI 31
5.2. Overview of Methods 32
5.3. Results 33
5.3.1. Social Expectations 34
5.3.2. Values perspectives 37
5.3.3. Legitimacy 39

6. CONCLUSION 43

6.1. Main conclusion 43
6.2. Recommendations 44
6.3. Issues for reflection 46

7. REFERENCES 48

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

Table of tables

Table 1 Legitimacy framework. Source: adapted from (Binz et al., 2016; Harris-Lovett et al., 2015; Scott, 1995; Suchman, 1995) 30
Table 2 - Illustrative examples of the legitimacy categories from interviews..... 41

Table of figures

Figure 1 Nine demonstration cases of the ULTIMATE project. This white paper highlights Circular Economy challenges and expectations in two demonstration cases namely Tarragona in Spain and Tain in the United Kingdom. 12
Figure 2 A simple model of the linear economy 15
Figure 3 The circular economy model (European Parliament, 2020) 15
Figure 4 Environmental sustainability and social performance of Spain (left) and UK (right) relative to the“safe and just space”framework..... 18
Figure 5 The Hierarchy of Resource use 19
Figure 6 The pyramid of corporate social responsibility, by Caroll (1991, p.40) 21
Figure 7 Organisation of Economic Cooperation and Development (OECD 2011) identified seven gaps in multi-level water governance that may emerge in the governance of multi-faceted challenges such as the water in the Circular Economy. 28
Figure 8 Diagram representing the general idea of the CE for the water sector. 33
Figure 9 Prior awareness of the term 'circular economy'..... 35
Figure 10 Expectations for environmental responsibility 35
Figure 11 Expectations for social responsibility 36
Figure 12 Preferences for CE projects and governance 37
Figure 13 Summary of responses to the four 'values perspectives'..... 38
Figure 14 Summary of surveys results for the three legitimacy categories. […] abbreviates ‘system/s like this’ in the statements. N = Normative, C = Cognitive, P = Pragmatic. 39

The project leading to this application has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 869318

List of acronyms

CE	Circular Economy
CSR	Corporate Social Responsibility
DNSH	Do no significant harm
EC	European Commission
EU	European Union
OECD	Organisation of Economic Cooperation and Development
RRI	Responsible Research and Innovation
SJS	Safe and Just Space theory of human needs
UN	United Nations
WSIS	Water Smart Industrial Symbiosis

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

1. Introduction and outline

1.1. General introduction

We face unprecedented challenges related to water, waste, and climate change that are threatening the stability of our economies and the integrity of natural ecosystems that we rely on (EC 2020; Ghisellini et al. 2016; Koop and Van Leeuwen 2017). Societies generate massive amounts of solid waste. Poor waste management, ranging from non-existing collection systems to ineffective disposal, causes air, water and soil contamination. Although data availability is poor, it is estimated that at a global scale, about 80% of the wastewater is released into the environment untreated (UNESCO 2017). At the same time, freshwater demand is expected to increase rapidly, particularly for industrial production in urban areas (UNESCO 2015) and we are expected to face a 40% freshwater supply shortage worldwide by 2030 (2030 Resources Group). Wastewater can be considered a largely untapped resource of freshwater and materials. In Europe, the advanced level of wastewater treatment, therefore, could facilitate more circular and water-efficient approaches that can protect industries that provide vital services, economic growth and employment.

In contrast to the traditional linear economic model of 'take-make-dispose', a Circular Economy (CE) is designed to be regenerative and to decouple growth from the consumption of finite resources. The CE aims to keep products and materials in use, reduce waste and, as a consequence, enable the regeneration of natural systems. In many cases, there is a special focus on closing-the-loop production patterns for urban and industrial waste as a way of enhancing the harmony between economy, environment and society (Ghisellini et al. 2016).

While China has adopted CE as a top-down national political objective (e.g. Su et al. 2013), most global regions, such as the European Union (EU), consider the CE as an approach to design bottom-up environmental and waste management policies (EC 2020). The bottom-up European approach towards achieving a CE requires support by innovation designers and intermediaries in practices, policies and decision-making. In this context, the transformation from a 'take-make-dispose' towards a CE requires a strong science-policy dialogue, collaboration and innovative designs that enable new business models (e.g. Stahel 2013). However, beyond these technical, policy and economic aspects, ethical drivers and societal expectations may be equally critical in enhancing this transformation towards a CE. Within this white paper, we dive into the moral and ethical drivers and motivations for adopting CE practices. We also examine societal expectations around CE and reflect on the level of influence that these societal expectations may have in adopting CE practices. In doing so, we will focus on a specific niche in the CE system, that is the role of water in the circular economy. More specifically, we consider the role of water/wastewater both as a reusable resource but also as a vector for energy and materials to be extracted, treated, stored and reused within an industrial context. This can be summarised as 'Water Smart Industrial Symbiosis' (WSIS) (https://ultimatewater.eu/water-smart-industrial-symbiosis/).

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

1.2. Aim and scope

In this white paper, we aim to develop a better understanding of two strongly intertwined aspects of the transformation towards a circular economy:

(i) Moral and ethical drivers and motivations for companies to adopt CE practices (with a particular focus on examples of WSIS);

(ii) Societal expectations regarding the adoption of such CE practices.

Corporate moral and ethical drivers are explored through the concepts of Corporate Social Responsibility (CSR) and Responsible Research and Innovation (RRI). RRI implies that researchers, citizens, policymakers, businesses, third sector organisations etc. work together throughout the research and innovation process to help align both the process and its outcomes with the values, needs and expectations of society. RRI is compulsory in most projects financed by the EU's H2020, including for ULTIMATE. Moreover, CSR is a common and relevant concept to address the moral legitimacy and organizational expressiveness of firms. In this white paper, we specifically address how firms' contributions to a CE might fit with these broader concepts of CSR and RRI, and whether such contributions might be viewed as 'greenwashing' practices.

To explore societal expectations regarding CE practices, we first outline some background and focus on legitimacy theory and how it might be applied to CE. We then present findings from empirical work in two countries (the UK and Spain) that are home to demonstration cases for the ULTIMATE project, to explore how societal expectations might be linked with the legitimisation CE systems. In particular, industrial sites in Tain (United Kingdom) and Tarragona (Spain) form a basis for exploring ethical drivers and societal expectations related to WSIS and CE in general (Figure 1). Tain is a whiskey distillery and a specialised industrial water solutions provider and operator. Tarragona is an industrial symbiosis site consisting of 30 companies and an industrially-owned water-energy-telecom multi-utility. For a more detailed description of the two demonstration cases, we refer to the assessment of baseline conditions for all demonstration case in D1.1 sections 2.1 and 2.7.

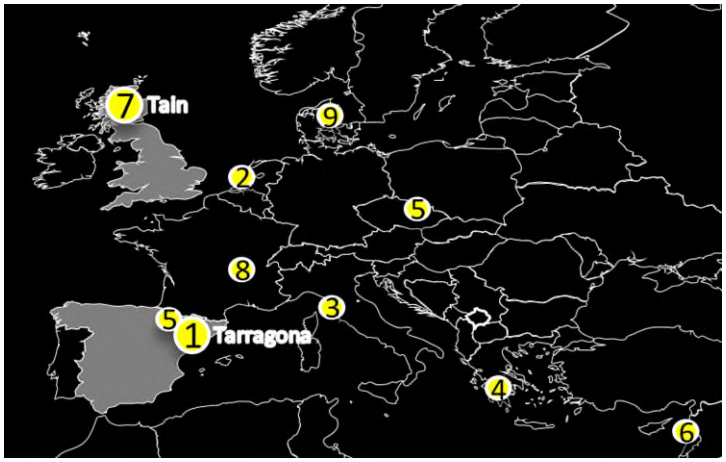

Figure 1 Nine demonstration cases of the ULTIMATE project. This white paper highlights Circular Economy challenges and expectations in two demonstration cases namely Tarragona in Spain and Tain in the United Kingdom.

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

1.3. Linkages with other working packages and tasks

The topics explored in this white paper can offer significant insights into other tasks and work packages (WPs) in the ULTIMATE project. The moral-ethical drivers of CE, and the societal expectations around it, form two rather fundamental facets that shape the socio-economic and business environment of circular systems, and in turn, impact the feasibility of new business models and arrangements. Societal expectations regarding circular products tend to shape corporate moral-ethical choices and vice versa. However, societal expectations are an important but rather unknown factor for the establishment of circular systems in sectors such as agri-food, food and beverage processing, biotech, chemical and petro-chemical industries. Hence, the discussion, questions and empirical findings outlined in this white paper may contribute to overcoming a major hurdle in the transformation towards a CE through the adoption of WSIS: the step from successful pilots (niche innovations or incubation room) towards large-scale application through viable symbiotic business models (socio-technical regime change) (e.g. Geels and Schot 2007).

The tight and well-organised interdependencies in current production-consumption processes tend to amplify existing routines and rules that foster more efficient interactions. As a result, existing practices become increasingly faster, more reliable, at decreased time and costs, and with fewer errors as well (Geels 2006). Hence, a socio-technical regime is self-reinforcing continuously and leaves little incentive to switch to alternative learning paths (Hammond et al. 1998). However, the initial gain in efficiency is often offset by limited scope and inflexible structures preventing learning, adaptation and anticipation to changing circumstances such as diminishing availability of freshwater, raw materials and decreasing biocapacity (e.g. Brown et al. 2011). This is known as path-dependency.

To overcome the challenges of path dependency, WSIS regimes need to be established. Such reshaping requires the development of routines and technological trajectories in the engineering community (core aim of WP1). Hence, systematic technological and design interlinkages need to be established too (core aim of WP2). These interlinkages are shaped by regulations and standards (task 4.2), new governance arrangements (task 4.3) but perhaps primarily by ambitions of both companies, policymakers and other stakeholders. Hence, the moral-ethical drivers and societal expectations can be a point of reference for innovative stakeholder engagement models in WP3. In particular, business-to-business engagement in task 3.2, citizen engagement in task 3.3 and their interaction in the Living Labs (task 3.4) may benefit. Through these stakeholder engagement processes, the moral-ethical drivers and societal expectations outlined in this white paper may form – together with the demonstration of technical-symbiotic systems – one of the key considerations for the exploration of new business models and arrangements for large-scale application (core aim of WP5).

1.4.Reader's guide

Firstly, to obtain a better understanding of what should be the moral and ethical drivers and motivations for companies to adopt CE practices, chapter 2 outlines the main

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

premises of what constitutes a sustainable CE based on state-of-the-art research. Next, chapters 3 and 4 discuss the role of Corporate Social Responsibility (CSR) and Responsible Research and Innovation (RRI) as drivers for the adoption of CE systems and practices. Throughout chapters 2, 3 and 4, we present several 'issues for reflection', which are points that can help stakeholders enhance the sustainability of CE schemes and those of the ULTIMATE project in particular. Chapters 5 focuses on the role of societal expectations regarding CE. As such, first chapter 5 characterises societal expectations based on results of large-scale surveys conducted in the United Kingdom and Spain and then scrutinizes the role of societal legitimisation of CE systems. Finally, chapter 6 provides the concluding remarks and take-home messages related to ethical drivers and societal expectations that can enhance the sustainability of CE practices and water-smart symbioses.

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

2. Premise of a circular economy

2.1. From Linear to Circular Economy

CE is a concept currently promoted around the world as an approach and possible solution for moving towards sustainability. CE is to replace the long-lasting linear economy regime in mainstream economics. The linear economy is composed of a take-make-dispose approach; we take or extract natural resources, we make goods, and when we no longer want to use these goods, we dispose of them as waste (Nilsen, 2008).

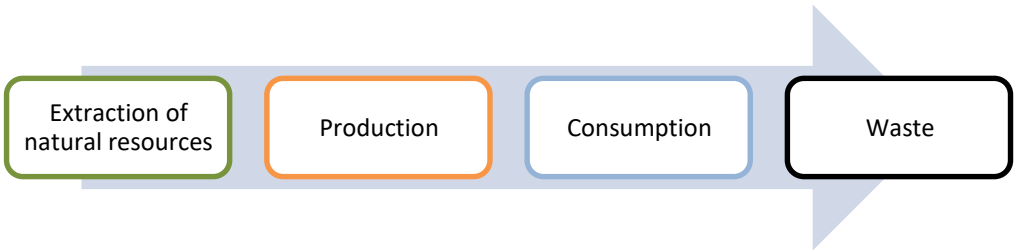

Figure 2 A simple model of the linear economy

In the linear economy, waste has no value, and this is a main cause of the enormous waste problems that we have created. For instance, plastics are now practically everywhere in our biosphere. Plastic waste degrades into small pieces (Derraik 2002). Consequently, concentrations of plastic particles have been detected frequently in rivers, lakes, groundwater and drinking water across the globe (e.g. Koelmans et al. 2019; Koop and Van Leeuwen 2017). These micro and nano plastic particles originate from larger pieces of plastics, macro plastics, which form 'soups' in five major ocean gyres that affect many marine animals by ways of ingestion and physical entrapment (Zarfl et al. 2011, Nilsen, 2019).

Figure 3 The circular economy model (European Parliament, 2020)

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

In an idealised CE, there is no waste, only resources. To achieve this, instead of discarding resources as waste we are to repair, reuse and recycle resources. This then leads to a reduction in the use of raw materials, as illustrated in Figure 3. Furthermore, in an ideal CE, the raw materials, or primary resources, are to be replaced by secondary, tertiary etc. resources, which are resources reused and recycled as many times as possible before the materials wear out. In practice, and especially in a period of transfer, recycled materials are not in replacement of raw materials but are used in addition to raw materials.

A reduction in the extraction and consumption of a particular raw material implies a change in existing patterns of production and consumption. This does not mean a reduction in total economic activity. On the contrary, it means new activity is induced through reuse and recycling, and through the use of secondary, tertiary etc. raw materials. Nonetheless, the change in material input into the economy in other projects has a moral obligation to ensure, to the best of their ability, that their work contributes to a more sustainable CE. What constitutes sustainability is presented below through state-of-the-art research on planetary boundaries.

The traditional way of addressing sustainability has been the 3-pillar model of social, economic and environmental sustainability. For business, sustainability is often expressed by using the triple-bottom-line reporting on both financial status as well as accounts on the social and environmental contributions, or reductions. However, there is increased recognition that environmental sustainability is a prerequisite for just and safe social and economic sustainability in the long run. Hence, from an overarching perspective, there is a hierarchy between these 3 pillars which is often overlooked (Elkington, 2018; Folke et al., 2016). The lack of hierarchy is also symptomatic in the use of the United Nations (UN) sustainable development goals. We need to better take into account that there is also a hierarchy between the UN's sustainable development goals and the interlinkages between the goals, both the positive and the negative (Nilsen, 2020).

In general, resistance against change can be explained as natural human and organizational inertia. Moreover, firms are to various degrees dependent on the past, a phenomenon also described as path dependency. But there are also power structures at work, as recycled materials are in direct competition with the equivalent primary raw materials. One explanation for the resistance towards change is that the extraction of raw materials is in the interest of powerful industrial actors and countries (Nilsen, 2020, Velis et al., 2015). "What is clear from the literature is that the greatest impediment to change is the inertia that the current linear global business model exerts on change" (Brocklehurst et al., 2015, p. 40). This has especially been used for explaining why big fossil fuel companies do not convert faster to renewable energy firms. These power structures are an underexplored aspect of closing the loop from a linear to a CE.

2.2. A Sustainable Circular Economy

In this section, we discuss why a CE is not necessarily sustainable, and at the end of the section, we offer issues for reflection, which are intended to help enhance the

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

sustainability of circular projects and firms. As we have mentioned, a CE is not necessarily sustainable and the policy sphere in the EU is working towards closing gaps towards a more sustainable CE. But what are the premises for a sustainable CE, according to state-of-the-art sustainability research?

First, we need to start by defining the concept of sustainability, which has been used in so many different ways that it has largely become non-committal. The most well-known definition of sustainable development is from the Brundtland report (1987) stating that "Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs". Following this definition, social and economic development has to take place within the carrying capacity of the earth, the biosphere. In sustainability research, the notion of the integrity of planetary boundaries is replacing the more vague concept of environmental sustainability. Specifically, the planetary boundaries framework defines the biophysical conditions that provide a high chance for the Earth to stay in a state that can support a safe space for humanity (Rockström et al., 2009; Steffen et al., 2015). The nine hitherto defined planetary boundaries are climate change, loss of biodiversity, biogeochemical flows of phosphorus and nitrogen, land-system integrity, global freshwater use, ocean acidification, and novel entities including various forms of chemical pollution, aerosol loading and stratospheric ozone depletion. The first four of these boundaries are thought to have been exceeded already, hence posing the most immediate threat to our societies as we know them.

These challenges are on a global level. To try and disaggregate these challenges to the countries in where ULTIMATE takes place, we have used a model developed by the University of Leeds named 'A Good Life For All Within Planetary Boundaries' (O'Neill et al., 2018), which is the basis for a tool in which the environmental sustainability and social performance of individual countries can be viewed, relative to the "safe and just space" (https://goodlife.leeds.ac.uk/countries/). This theory of human needs developed by O'Neill et al. (2018) underpins the Safe and Just Space (SJS) framework proposed by Raworth (2017), better known by the name of her book, Doughnut Economics. The SJS framework combines the concept of planetary boundaries with the complementary concept of social boundaries. It visualizes sustainability in terms of a doughnut-shaped space where resource use is high enough to meet people's basic needs, but not so high as to transgress planetary boundaries.

In the latter part of this paper, we present empirical data from two countries, Spain and the UK. We have therefore picked these countries to illustrate the tool and have pasted the results[1] in Figure 4. The ecological ceiling and social foundation are shown by dark green circles. Blue wedges illustrate social performance relative to a threshold associated with meeting basic human needs. Green wedges indicate resource use relative to a biophysical or planetary boundary, associated with sustainability. Red wedges display shortfalls below the social threshold or overshoot beyond the biophysical or planetary boundaries. Grey wedges are missing data, and wedges with a dashed edge extend beyond the chart area. A country offering a good life for all of its citizens within planetary boundaries has blue wedges that reach the social foundation and green wedges within the ecological ceiling. In total, only 16 countries

[1] In this tool it is not possible to choose Scotland, nor the EU level.

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

remain within all 7 per capita biophysical boundaries, while 48 countries transgress 6 or more of them. No country performs well on both the biophysical and social indicators of this model. In general, the more social thresholds a country achieves, the more biophysical boundaries it transgresses, and vice versa. Many wealthy nations achieve the majority of the social thresholds, but at a level of resource use, that is far beyond the ecological ceiling (O'Neill et al., 2018, p.90).

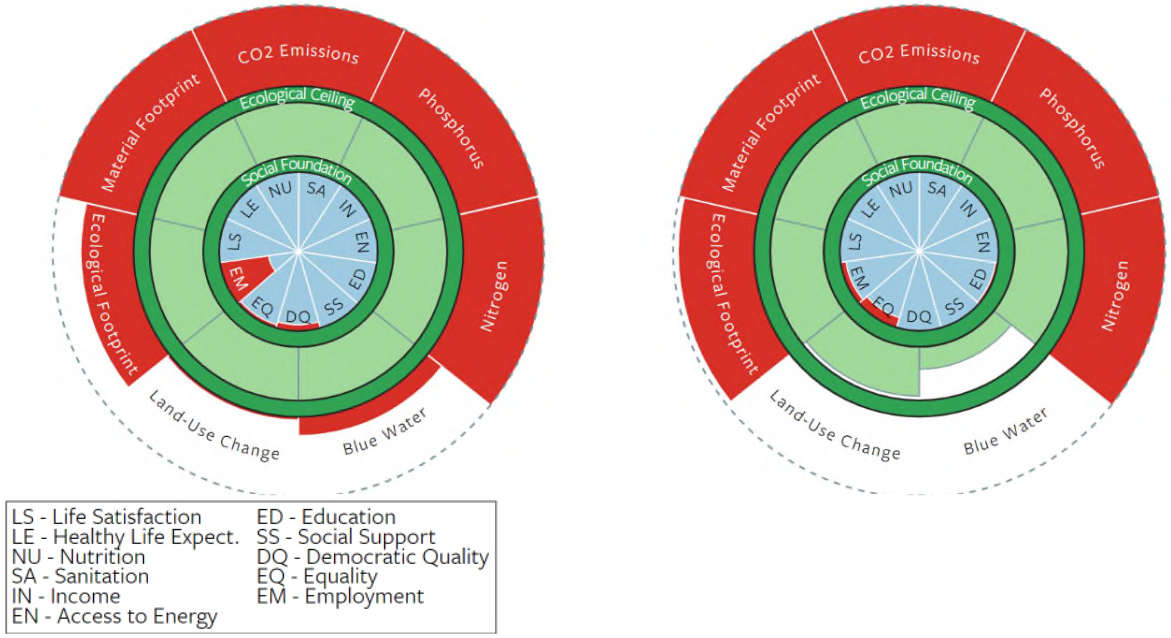

Figure 4 Environmental sustainability and social performance of Spain (left) and the UK (right) relative to the "safe and just space" framework.

Although the model is generalised and abstract, these figures give some indication that the ecological ceiling in the two selected countries is exceeded for (i) CO_2 emissions, (ii) biogeochemical flows of phosphorus and of (iii) nitrogen, (iv) material footprint and (v) ecological footprint. The biophysical boundaries of (vi) blue water and (vii) land-use change, are shown to be exceeded in Spain, but not in the UK. A thorough explanation of these factors is available in O'Neill et al. (2018).

Broadly speaking, the WSIS demonstration cases in the ULTIMATE project can help us remain within ecological ceilings by contributing to recycling water and nutrients and reclaiming energy in industrial symbioses. They also contribute to reducing CO_2 emissions, reducing biogeochemical flows of phosphorus and nitrogen, and improving the blue water indicator. This can be described as the contribution of ULTIMATE with regard to a sustainable CE.

In a CE, there are different ways forward for industry to mitigate pressures on the ecological ceiling. A key is to use fewer primary resources, and once we do extract primary resources, we must keep them in the economy for as long as possible. To do this, it is common to differentiate between slowing, narrowing and closing the resource loops in a CE (Bocken et al., 2016).

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

Still, none of these approaches has an explicit goal of reducing the extraction of primary resources. It is assumed that this will happen indirectly, as we produce and use more products based on reuse, repair and recycling. But it is also possible that the extraction of primary raw materials, for instance for producing energy for the CE, would not be reduced. Therefore, in line with a moral obligation to contribute to a sustainable CE we need to have an explicit focus on reducing reliance on primary raw materials.

Issues for reflection

- **Check specific societal challenges of the home country or region of the industrial symbiosis at hand. Which social factors are not satisfactory? Can you do something to increase positive contributions, and reduce potential negative effects through the undertaking of the CE scheme?**

2.3. The hierarchy of resource use

In the previous sections, we argue that one of the key moral drivers for the adoption of circular systems is the need to reduce pressure on planetary boundaries, and that a shift towards circular systems should maintain an explicit focus on reducing the extraction of primary raw materials. This explicit focus is present in a concept known as the waste hierarchy which was introduced in the EU long before the CE (Nilsen, 2019, Williams, 2015). The EU introduced the waste hierarchy as early as 1975, and it was further strengthened in 2010 with the aim of turning EU member states into “recycling societies” (EU, 2008). The waste hierarchy has the same positive and necessary features as the CE to achieve sustainability. In addition, the former offers a more explicit priority via the hierarchy, than the circular loop of a CE. An explicit priority is useful in clarifying and reminding ourselves on how we need to address the overall challenges in light of the severe ecological degradation that we now face (Rockström et al., 2009, Steffen et al., 2015). We present the hierarchy to make the point that ‘reduction’, which is at the top of the waste hierarchy, must not only be connected to reducing waste but must begin by reducing the extraction and use of primary resources (Figure 5). Therefore, we use the term ‘hierarchy of resources’ to make our point that reduction is not only connected to reducing waste.

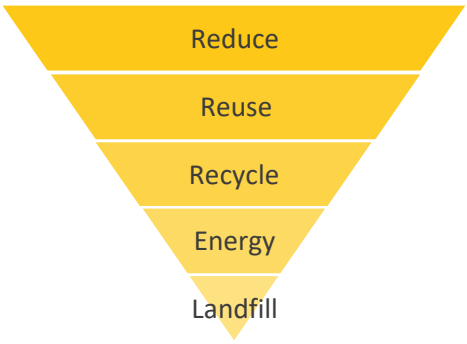

Figure 5 The Hierarchy of Resource use

The project leading to this application has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 869318

As with the CE concept, the hierarchy of resource use has shortcomings. These have been identified as a lack of incentives for following the order of treatment of resources in the waste hierarchy, as well as a lack of clear guidance and policy support in choosing and implementing the best environmental option (Van Ewijk and Stegemann, 2016). Still, the top level of the hierarchy, reduce, must also be a part of the CE concept.

Issues for reflection:

- **Are there linear processes in the economy that if transformed into circular processes may lead to increased pressure on the ecological ceiling, indirectly or directly? If so, how can this be addressed, if not changed?**
- **Are there power structures among the stakeholders of the CE scheme that may slow down the transition from a linear to a sustainable CE, indirectly or directly? If so, how can this be addressed, if not changed?**
- **Are there costs of the CE transition that should be taken into account because they raise affordability issues for marginalised groups? What are these costs and which social groups are affected? How can this issue be addressed?**

In the following sections on CSR and RRI, we dig deeper into the possible social drivers for businesses/industries to support a transition to a CE.

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

3. Corporate Social Responsibility

3.1. An introduction

Corporate Social Responsibility (CSR) is a concept advocating that private companies have obligations towards society beyond making a profit. In this section, we discuss the concept of CSR from a normative perspective and discuss how it may act as a driver to support the adoption of CE systems.

The pressure on businesses to take social responsibility has increased over the last few decades. Globalization and other structural changes in society and economic life are some of the reasons for this development. Strengthening of corporate power means, for many people, increased social responsibility for businesses. However, some might still argue that the business realm is free from moral responsibility in the pursuit of pure economic gains. The concept of CSR in the academic literature originates with Bowen in 1953 and his 'Social responsibilities of the businessman'. This traditional understanding was that CSR is *a concept whereby companies integrate social and environmental concerns in their business operations [procedural] and in their interaction with their stakeholders on a voluntary basis* (Commission of the European Communities, 2001). A way to characterize a firm's CSR is to look at the component parts, as presented by Carroll (1991). It is suggested that firms have four kinds of social responsibilities: economic, legal, ethical, and philanthropic. Furthermore, Carroll also presents these four components in a pyramid, as shown in Figure 6.

Figure 6 The pyramid of corporate social responsibility, by Caroll (1991, p.40)

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

3.2. Differences between regions

The different kinds of responsibilities of firms presented in Figure 6 above have always existed to some extent. However, the form these responsibilities take differs in time and between regions. Companies originating from the USA have been world-leading in using the concept of CSR (Matten and Moon, 2008).

In Europe, firms have also practised CSR, but have not been as explicit about it. The need for an explicit CSR has been considered less important in Europe because CSR has been handled implicitly through the legal and organisational systems surrounding firms. Examples of this are the influence of trade unions, industry associations, national regulations and agreements on pay, work conditions and education systems. The need for explicit CSR in highly regulated domestic markets has historically been viewed as low. Labour rights and environmental performance has been enforced through laws, regulation and tripartite agreements. There has been a tradition of private firms cooperating closely with governments, and strong institutions securing stakeholders' interests. However, globalization has also affected the domestic socio-cultural and political environment of businesses, thus challenging the traditional ideals of the Northern European countries, among other things, through a higher level of industry self-regulation. One driver for CSR in these countries has been a perceived governance gap in the global economy (Carson and Nilsen, 2021), which also played out through differences in firms' home country and their host country values.

Hence, there are variations of CSR between regions and countries. Still, internationalisation has made organizations increasingly similar concerning, for instance, codes of conduct and environmental standards. This more level playing field has inspired an explicit CSR as a central management concept, also in Europe. The transfer to a more explicit CSR in Europe is also driven by stakeholders' expectations of greater responsibilities. And, as often seen, the expectations for large companies are bigger, including those operating abroad in less regulated markets.

The change from an implicit to an explicit CSR is also used by firms as an opportunity for organizational expressiveness. Specifically, it is also used as an opportunity for legitimisation or re-legitimisation, either of existing business models or of a reformed business model.

3.3. CSR as a driver for Circular Economy

In this section we consider how the adoption of circular systems by businesses might fit with the responsibilities outlined in Figure 6, and whether/how CSR might be acting as a driver for CE.

The hierarchy described in Figure 6 suggests that a company's economic and legal responsibilities are the most important, foundational drivers of its activities. This may help explain the slow progress of CE uptake among businesses and industries in the water and wastewater sector – returns on investments circular systems can be slow, and markets for recovered materials can be lacking, making the profitability of such investments uncertain. Furthermore, the legal responsibilities around circular systems

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

are still not well developed. Law is said to be society's codification of right and wrong. But in the transition to a CE, the law is sometimes lagging, making the fulfilment of firms' legal responsibilities uncertain as well.

It is the top two levels of the pyramid (ethical and philanthropic responsibilities) that can be considered as potential moral and ethical drivers for the adoption of circular systems. Companies (and their customers and other stakeholders) may view the shift towards CE as part of 'doing what is right' and 'being good corporate citizens'. The strength of these drivers will depend in part on the extent to which companies (and their customers and other stakeholders) view circular systems as more sustainable in the context of the planetary boundary imperatives discussed in the previous chapter. It is these views (in part) that we explore through the empirical work presented in chapter 5.

For partners in the ULTIMATE project, there are perhaps two ways in which they might utilise the adoption of circular systems to make a material contribution to a CE, and express this as a manifestation of CSR. Contributing on a material level to a CE can be done through making the core activity of firms more in tune with the requirements of a sustainable CE. This can be done through incremental improvements or more abrupt and substantial improvements in business models. A material contribution to CE may also happen by strengthening support systems and infrastructure of the firms, for instance by being part of an industrial symbiosis for reusing and recycling resources. To illustrate this difference, transforming an oil company to become a firm for renewable energy is a change in the company's core activity, electrification of oil production is improving the support systems of a core activity. It is worth reflecting on these differences and being clear and transparent about which type of material contribution to a CE is being pursued in any circular demonstration case, and how it may contribute to CSR.

Awareness and transparency on which parts of the business model are circular and sustainable – and which are not – is of importance in the transition to a CE, and when communicating about demonstration cases. In line with the previous sections, this means that the activity must not only contribute to a CE but also, that it does not contribute to further leakages in the ecological ceiling nor in the social foundation (O'Neill et al., 2018). Such transparency is important to avoid 'greenwashing', which could ultimately undermine a firm's CSR.

The definition of greenwashing in recent EU documents refers to *"(…) the practice of gaining an unfair competitive advantage by marketing a financial product as environmentally friendly, when in fact basic environmental standards have not been met."* (Council of the EU, 2020). In the context of transitioning towards CE, this definition could be expanded – if an explicit CSR and explicit CE is used by a firm as a form of marketing without taking into account possible counteracting effects on either the ecological ceiling or social foundation, we are in fact in danger of greenwashing. In essence, greenwashing may occur if a circular system is labelled as more sustainable (and claimed as an expression of CSR) when in reality it creates negative ecological or social impacts. The ambition of being transparent and clear on the different ways in which industrial symbiosis systems, and their associated business models, might

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

contribute to a sustainable CE will hopefully help avoid greenwashing and ensure that circular systems are an appropriate reflection of CSR.

Issues for reflection:

- **Be aware of the difference between improvements in the core activity of a firm, and improvements in support systems or infrastructure.**
- **Be transparent about what kind of changes are induced with the CE scheme; firm level improvements (incremental or substantial, core level or support systems), industrial level improvements, policy changes, or wider societal effects.**
- **Be explicit and transparent about the preconditions on which the different improvements rest. Who or what do you need for these preconditions to be fulfilled? Are the constraints at firm, industrial, policy, societal, local or global levels? Which factors does the scheme control, and which are outside the scheme's control?**
- **Discuss possible counteracting effects, in terms of sustainability. This can be done by various tools; e.g. by addressing interlinkages of sustainable development goals - or by using models like presented in figure 3 and 4.**

4. Responsible Research and Innovation

4.1. An introduction

In this chapter, we discuss the relationship between Responsible Research and Innovation (RRI), the CE in general, and ULTIMATE (both internally for the project and externally toward society). RRI has been defined as *"a transparent, interactive process by which societal actors and innovators become mutually responsive to each other with a view to the (ethical) acceptability, sustainability and societal desirability of the innovation process and its marketable products (in order to allow a proper embedding of scientific and technological advances in our society)"* (Von Schomberg, 2012). More simply put, RRI intends to share decision-making with societal actors through more transparent and participatory processes to create research and innovation policy informed by societal needs (European Union, 2012).

The EC's RRI framework focuses on six dimensions (or thematic elements): engagement of citizens and stakeholders, gender equality, open access, science education, ethics, and governance (European Union, 2012). For this report, the most relevant dimensions from the EC's RRI framework are (i) engagement of citizen and stakeholders, and (ii) governance, which are both discussed in subsequent sections of this chapter. Other dimensions, for example, open access and gender equality, are discussed in more detail in other ULTIMATE deliverables. Deliverable D7.5, *Ethical Principles and Guidelines for Responsible Research and Innovation*, presents the main RRI dimensions, as part of section 2 (*Ethical Aspects and Dimensions*). The RRI dimension of science education is not part of ULTIMATE as such, however, the project may be used as an example in courses taught by researchers involved in the project.

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

4.2. Relevant Policies to support RRI

In 2015, the EC adopted its 'action plan for a circular economy', which aimed to boost global competitiveness, foster sustainable economic growth and generate new jobs (European Commission, 2015). Similar initiatives have taken place outside the EU in countries such as China, Japan, Canada and Norway (Korhonen et al., 2018, Norwegian Ministry of Climate and Environment, 2017). In 2019 the European Commission launched The Green Deal, a plan for making the EU's economy sustainable. The overall goals are no-net emissions of greenhouse gases by 2050, decoupled resource use from economic growth, and to leave no person and no place behind (European Commission, 2019).

Two other EU policy documents adopted in 2020 by the European Commission, also part of the Green Deal, are relevant to this white paper. Firstly, 'Sustainable finance' is a work stream to support the European Green Deal channelling private investment into the transition to a climate-neutral economy. This policy area, which is also still developing, will have implications for economic activities in the EU regarding finance and the opportunity to refer to activities as 'sustainable', thus attempting to address the problem of greenwashing. A specific part of 'Sustainable finance' is the Taxonomy, which, amongst other things, lay out specific screening criteria for each economic sector. The Taxonomy refers to the concept of 'Do no significant harm' (DNSH) and aims to ensure that progress against some environmental objectives is not made at the expense of others (EU Technical expert group on sustainable finance, 2020). Thus, assessment against DNSH criteria may help to in making a CE more sustainable. Secondly, 'A new circular economy action plan' (European Commission, 2020a, chapter 3.7), also part of the Green Deal, includes the following regarding reusing water:

- **The new Water Reuse Regulation will encourage circular approaches to water reuse in agriculture. The Commission will facilitate water reuse and efficiency, including in industrial processes. Furthermore, the Commission will develop an Integrated Nutrient Management Plan, with a view to ensuring more sustainable application of nutrients and stimulating the markets for recovered nutrients. The Commission will also consider reviewing directives on wastewater treatment and sewage sludge and will assess natural means of nutrient removal such as algae. (European Commission, 2020a, chapter 3.7).**

It is reasonable to state that the EU now has some momentum in transforming a linear economy to a more circular one. This also means that actors involved in this transformation, and also the broader stakeholder sphere, must be up-to-date with the policy processes that in due time are passed into laws and regulation. There is also room to participate and try to influence these processes, as in any other democratic country. Citizens and stakeholders participating in a democratic system is an important pillar in sustaining a democratic system.
Issues for reflection:

- **What are the relevant policy documents for your sphere, and are you working in line with the trend of these documents? Why, why not?**

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

- **Are there relevant policy opportunities or processes where you are not present? Should we participate, and at which level? Local, regional, national, EU, or, international for instance through relevant UN processes?**

4.3. RRI and Public engagement

Public engagement, as the first dimension of the EC's RRI framework, aims to facilitate inclusive and participatory processes to foster more socially desirable science and technology outcomes (European Union, 2012). Through this lens, the public engagement dimension of RRI is highly relevant to the development of creative and more widely acceptable CE solutions that engage with the public's needs and expectations. Public engagement is a focal point in projects financed by Horizon 2020, as is ULTIMATE. In Horizon 2020, public engagement is recommended to help facilitate the co-creation of R&D with the public and civil society organisations through multi-actor dialogues. Moreover, it is a goal to include a wide diversity of people that may not normally interact with science and technology projects and to create the space for ethical issues to be explored. From the perspective of Horizon 2020, public engagement is considered important as it allows the consideration of a broad range of societal needs, may help achieve a shorter time to market and greater consumer acceptability, and can empower citizens to participate in decision making (European Commission, 2021).

The need to move from a linear to a CE has broad support in politics and in academia. In this respect, ULTIMATE aims to be an example of this transition. Still, a CE must strive to be sustainable, both with regard to the ecological ceiling and in its social foundation. The social foundation factors of the demonstration case countries which are not yet within the sphere of constituting a safe and just space are employment, equality, and democratic quality.

Public engagement through ULTIMATE may address democratic quality, however minor, which aligns with the public engagement aims of RRI. Public engagement may also aim to address equality in public participation through engaging with a broader spectrum of perspectives. More indirectly, ULTIMATE may have implications for employment through the shifting from a linear economy to a CE.

Public engagement can be approached from two conceptual perspectives. From the perspective of science, a top-down approach may occur, as formulated by Strand and Rommetveit (2019, p.5),"How do we educate, reassure and calm down the ignorant public and make them trust us, trust science again". Here, public engagement has a normative and pre-concluded purpose and, as such, is not open for negotiating or nuancing the research project or process. The second perspective, which can be described as a bottom-up perspective from the public to science, is formulated quite radically by Strand and Rommetveit (2019, p.4) as "How do we regain control over the runaway train of science and technology before it totally destroys our world?" Falling somewhere between these extremes, public engagement in RRI aims to facilitate a two-way process with feedback loops that allow for inclusive, participatory, multi-actor dialogues (European Commission, 2021). Thus, beyond the expectations of RRI,

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

making the most of public engagement has beneficial implications for ULTIMATE, and for the CE more generally, through co-creation of innovative outcomes. Through leveraging the principles of RRI, ULTIMATE and other CE initiatives can aim to engage with diverse actors, respond to the concerns and priorities of local communities, and help to reshape the CE discourse to enable a fairer and more just transition to a CE (Pansera et al. 2021). Furthermore, broader engagement may help facilitate better integration of socio-ethical issues in the CE (Inigo & Blok, 2019).

Issues for reflection:

- **Has your public engagement increased the likelihood that the CE scheme outcomes are more societally relevant and desirable?**
- **Can the CE scheme through public engagement foster a more scientifically literate society of knowledge-driven and empowered citizens?**

4.4. RRI and Governance

The second relevant dimension of the EC's RRI framework discussed in this report is governance. From an RRI perspective, the aim is to develop governance models that integrate public engagement as well as other dimensions (e.g. gender equality) of the EC's framework (European Union, 2012). Governance refers to the process of governing the action and structures of states, markets, trade, law, civil society, networks, and individuals. Since CE projects related to local, regional, national and EU level stakeholders, interests and policies, CE is typically embedded in a multi-level governance framework. The coordination between these multiple levels can result in water governance gaps such as those illustrated by the OECD (Figure 7). For ULTIMATE demonstration cases and the project as a whole, there would be benefits to characterising the governance gaps and, supported by the principles of RRI, devising ways to bridge these gaps, in particular, through engaging with multiple actors.

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

Figure 7 Organisation of Economic Cooperation and Development (OECD 2011) identified seven gaps in multi-level water governance that may emerge in the governance of multi-faceted challenges such as the water in the Circular Economy.

The tools for governance include, but are not limited to laws, norms, treaties, language, culture, and power (Thorseth and Schuppert, 2018). Governance is to move from a shareholder approach towards more inclusive processes involving societal actors. Good governance is to identify who has a stake and which needs, demands and expectations they have. To undertake this identification and to specify needs, demands and expectations there may be different levels of involvement for different groups of stakeholders. The type of engagement may range from inviting citizens to a public hearing, arranging stakeholder conferences, focus groups, interviews and surveys, or inviting representatives from some groups to boards of firms.

Facilitating a transition towards a sustainable CE, both with regard to the ecological ceiling and in its social foundation, depends not only on the development of new technologies but also on developing commensurate multi-actor governance processes (Pansera et al. 2021). For ULTIMATE, good governance is both considering and acting on a policy level, a good involvement of industrial related stakeholders, and involvement of the public. Moreover, novel governance models developed through ULTIMATE could have positive implications for evolving the thinking on RRI, for example, facilitating a better alignment of the RRI framework with business and industry practices (Dreyer et al., 2017).

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

5. Societal Expectations and Legitimisation

The second objective of this white paper is to examine societal expectations for the adoption of CE technologies and structures, to get a better picture of the wider societal value that may be realised from the shift towards a CE. To delve further into these aspects, we also sought to explore the social legitimacy of CE schemes, and how projects like ULTIMATE may be influencing the wider legitimisation of a CE. In this section, we first outline some background on legitimacy theory applied to the CE and we discuss the linkages between legitimacy theory and the concepts of CSR, Corporate Responsibility of a CE, and RRI. Following this, we outline the methodology for our empirical work as part of the ULTIMATE project in the countries of two demonstration cases – the UK and Spain. Finally, we present the results, exploring how social expectations might provide a foundation for the legitimisation of CE systems.

Earlier in Section 2.2, we outlined the concept of planetary and social boundaries, along with the status of social performance relative to thresholds associated with meeting basic human needs for the two countries housing our demonstration cases. Building from the social foundations (e.g., health, nutrition, education and so on), this section reviews the generative nature of social expectations (Borup et al., 2006) towards the CE to explore how such expectations might be leveraged to support the development, and legitimisation of a CE agenda and whether certain expectations, or social values, might enable or constrain shifts towards the CE. Social expectations are just one of the social dimensions to CE, where wider dimensions can encompass labour practices, human rights, social networks, social cohesion, or product compliance for health and safety (Padilla-Rivera et al., 2020). Previous reviews have concluded that discussions of the social dimensions in the academic literature concerning the CE have mainly focused on employment, although wellbeing, social networks, local community and social equity have also been discussed to some extent (Geissdoerfer et al., 2017; Padilla-Rivera et al., 2020). In this section, we consider the role of social expectations as a potential driver towards CE (and technological innovation and sustainability more generally - Lazarevic & Valve, 2017) and we discuss how social expectation might underpin legitimisation strategies towards the wider adoption of technologies and systems premised on CE approaches.

5.1. Societal Legitimisation

5.1.1. Legitimacy framework

We apply the concepts of organisational legitimacy (Scott, 1995; Suchman, 1995) and legitimacy of innovative technology (Binz et al., 2016; Harris-Lovett et al., 2015) to circular schemes. Legitimacy is defined as “a generalised perception or assumption that the actions of an entity are desirable, proper, or appropriate within some socially constructed system of norms, values, beliefs, and definitions” (Suchman, 1995, p. 574). In this case, the entity refers to the circular scheme of a given demonstration

The project leading to this application has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 869318

case, that is embedded in the society. Legitimacy has been conceptually described as having three categories: moral, cognitive, and pragmatic (Suchman, 1995). These categories are not fixed and others define regulative (Binz et al., 2016) and cultural (Scott, 1995) categories. Table 1 gives the definitions of these three legitimacy categories as well as some further sub-categories.

Table 1 Legitimacy framework. Source: adapted from (Binz et al., 2016; Harris-Lovett et al., 2015; Scott, 1995; Suchman, 1995)

Legitimacy category	Definition	Legitimacy sub-categories
Cognitive – *based on cultural account*	Cognitive legitimacy is the passive assumption that a circular scheme is comprehensible and taken-for-granted.	***Comprehensibility*** occurs when a circular scheme meshes with end users' daily lives and pre-existing cultural beliefs.
		Taken-for-grantedness is the highest form of legitimacy and describes a circular scheme as inevitable, necessary and not consciously questioned.
Moral– *based on societal norms and values*	Moral legitimacy is the active judgment of whether a circular scheme fits social values and norms in a manner that enhances societal welfare.	***Consequential*** legitimacy is based on a circular scheme accomplishment.
		Procedural legitimacy is based on an appropriate and expected way to implement and manage a circular scheme.
		Structural legitimacy refers to the constructed capacity to perform the circular scheme implementation and management.
		Personal legitimacy is based on implementing stakeholder's charisma.
Pragmatic – *based on self-interested direct benefits*	Pragmatic legitimacy is based on self-interested benefits brought by a circular scheme to its end users.	***Dispositional*** legitimacy refers to the perception that the implementing organisation is trustworthy and shares the same values as its end users.
		Influence legitimacy refers to the incorporation of end users in decision-making processes for the circular scheme.
		Exchange legitimacy refers to the perceived value of a circular scheme to its end users.

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

5.1.2. Legitimacy, CSR and RRI

The concept of CSR described in Section 0, refers to the obligations that companies have towards society. In that sense, it relates to the moral category of legitimacy as companies are expected to act in a way that is perceived to be 'right' by and for society. Normative systems include values and norms (Scott, 1995). Values are conceptions of the desirable or the preferable along with standards to which companies can be assessed and norms state how things should be done (procedural legitimacy – a sub-category of moral legitimacy) (Scott, 1995). Values and norms specify the roles that companies should have (Scott, 1995). More specifically, CSR stimulates procedural legitimacy. As part of the CSR framework, firms are expected to contribute to policymaking processes, which in itself links to the moral and pragmatic categories of legitimacy as it has to be done in a way that benefits society.

As mentioned in Section 3.3 (CSR as a driver for CE) raises the following question: what is the responsibility of companies to contribute to the CE? Given that laws and regulations are lacking in the context of the CE (cf. legal responsibilities of the pyramid of CSR in Section 0), other responsibilities take place. The ethical, philanthropical and economic responsibilities, confer an obligation to do the right thing (moral legitimacy), to act in a way that benefits the society (moral legitimacy) and to be profitable (pragmatic legitimacy), respectively (Suchman, 1995). Therefore, companies may engage in CE practices because it is the right thing to do for society (moral legitimacy) and because it represents an economic opportunity for them (pragmatic), not because they are legally required to.

The concept of RRI described in Section 4, has a "science with and for society" driver (European Commission, 2020b). In that sense, it relates to the pragmatic and moral categories of the legitimacy concept. More specifically, it refers to the influence legitimacy (a sub-category of pragmatic legitimacy), as the decision-making processes are shared between a broad range of stakeholders, including citizens (Harris-Lovett et al., 2015; Suchman, 1995). Additionally, RRI processes aim to be transparent and work towards citizens and stakeholders' best interests, which can improve trust in companies as it adheres to similar values as its customers (i.e., dispositional pragmatic legitimacy). The ultimate goal of the RRI concept is to align a company's processes and outcomes with societal needs, values and expectations, which refers to the moral category of legitimacy. As mentioned previously (Section 4), the governance aspect of the RRI concept ranges from informing (exchange legitimacy – a sub-category of pragmatic legitimacy) to consulting stakeholders (influence pragmatic legitimacy) in a way that considers societal expectations (moral legitimacy).

In summary, the concept of legitimacy relates to some of the six key dimensions of RRI (see page 24), specifically; (i) engagement of citizens and stakeholders (influence legitimacy – a sub-category of pragmatic legitimacy), (ii) open access (dispositional legitimacy – a sub-category of pragmatic legitimacy), and (iii) governance (moral and pragmatic legitimacy). The results from public surveys and follow-up interviews will extend this discussion to the ULTIMATE project by providing evidence of legitimacy perceptions at the two selected demonstration cases (see section 5.3.3).

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

5.2. Overview of Methods

We employed panel surveys and follow-up interviews for the collection of participant responses in the countries of our two demonstration cases, the UK and Spain. The survey samples were collected using quotas for demographics of age, gender and administrative region in the two countries based on the most recent census data. Other demographic details that were collected included their highest level of education, employment status, and whether the respondents had children or not. Following ethical approval and piloting, the surveys were conducted online using the Qualtrics survey tool. The UK survey was undertaken in January 2021 (n = 1,003) and the Spanish survey ran from March to April 2021 (n = 758). Alongside collecting demographic data to evaluate the representativeness of the samples, the surveys collected responses to questions on: (i) general awareness and knowledge of CE and waste management concepts, (ii) expectations for environmental responsibility, social responsibility, and preferences for CE projects and governance, (iii) four values perspectives, and (iv) legitimacy.

Agree-disagree statements were used to elicit perceptions of social responsibility, environmental responsibility and preferences for CE systems and for government involvement. These results were coded so that 1 was strongly disagree, 2 was somewhat disagree, 3 was neither agree nor disagree, 4 was somewhat agree, and 5 was strongly agree. To evaluate the four values perspectives and legitimacy, respondents were asked to compare sets of statements that represented the different conceptual dimensions. Using the Best-Worst method, respondents selected the dimensions that they most and least agreed with– other statements were not rated but assumed to fall in between the ‘best’ and ‘worst’. To summarise and illustrate the results, we coded the ‘best’ as equal to 1 and ‘worst’ as equal to negative 1 (-1). The middle options were given a value of zero.

For evaluating the respondents ‘values perspectives’ we used the four ‘types’ developed by Steg et al. (2014) commonly used in environmental research and consisting of sixteen statements. Consumer value, or worldview, segmentation is an approach that has been used in a range of fields from marketing, to political campaigns to climate change communication research (Hine et al., 2014) and water management (Brouwer et al., 2019) and the clustering of people around ‘types’ is common to psychology (e.g. personality types) and innovations research (e.g. Roger’s diffusion of innovation) as well as for assessing people’s environmental beliefs and behaviours (Bouman et al., 2018). The values statements were clustered, according to the typology, such that the perspectives we explored related to: (A) a ‘biospheric’ perspective, where statements related to respect and unity with nature and preventing pollutions, (B) an ‘egoistic’ perspective where statements related to control, authority, wealth, influence and ambition; (C) an ‘altruistic’ perspective where statements related to equal opportunity, peace and social justice; and (D) a ‘hedonic’ perspective where statements related to fun, enjoyment and pleasure.

For evaluating respondents’ legitimacy perceptions towards the CE, we developed four statements for each legitimacy category and a diagram that illustrated the general idea of a CE system for the water sector (Figure 8). The legitimacy categories built on Binz et al., (2016), Harris-Lovett et al., (2015), Scott (1995) and Suchman’s (1995) works,

The project leading to this application has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 869318

as previously described in Table 1. Statements from each of the three legitimacy categories were compared in sets (i.e., each of the four sets compared the three legitimacy categories together) using a Best-Worst methodological approach. Respondents were asked to reflect on the diagram when assessing the statements.

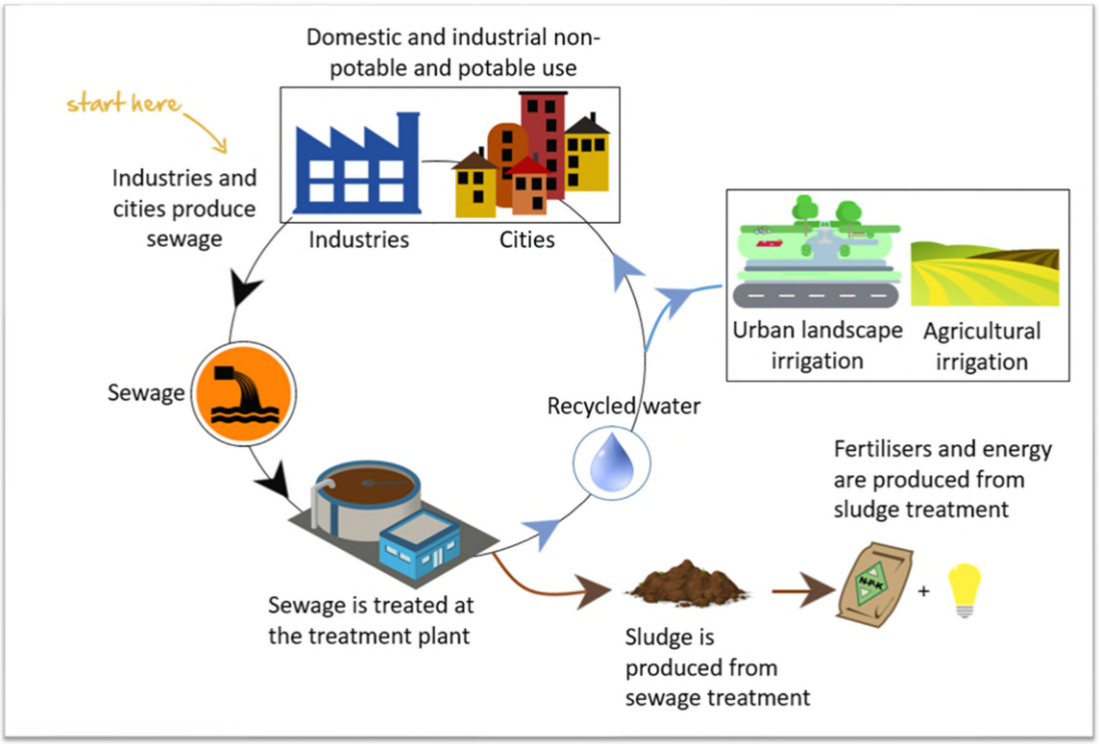

Figure 8 Diagram representing the general idea of the CE for the water sector.

Survey respondents were given the option to provide their email addresses for a follow-up interview to further explore the results from the legitimacy section of the survey. The UK follow-up interviews were conducted from March to April 2021 (n=10). The follow-up interviews collected responses to questions on: (i) the survey previously completed, (ii) legitimacy of the CE for the water sector, (iii) legitimacy of the selected demonstration cases, (iv) legitimacy of the implementing and operating companies and (v) legitimacy of the concept of CE.

Copies of the anonymised data set (survey and follow-up interviews), the survey questions and the follow-up interviews' topic guide will be made available on Cranfield University's online research data repository (https://doi.org/10.17862/cranfield.rd.14605233.v1).

5.3. Results

The results for the different data collection and conceptual approaches are presented in the following sub-sections. In summary, the main findings were:

- **General awareness of CE terminology could be improved. There are opportunities to develop strategies tailored to different demographics or country-specific contexts;**

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

- **In terms of social expectations, the results showed a general desire for companies to be both environmentally and socially responsible – Thus corresponding with the concept of CSR discussed in Section 3. The pattern of responses for both countries was similar. However, the results from Spain were slightly stronger (e.g. higher level of agreement) than the UK sample. Although some of the difference might be explained by the methods (e.g. sample characteristics), there may be cultural differences worth exploring in more detail;**
- **Survey respondents from both countries indicated a preference for some level of government intervention in the promotion of CE and that companies were expected to do more than just pursue economic goals;**
- **Results from the four values perspectives reinforced the notion that the respondents, and by extrapolation the wider public, favoured environmental (biospheric) and social (altruistic) perspectives. This result, therefore, adds to the evidence that societies expect companies and governments to advocate social and environmental responsibility;**
- **Survey and interview respondents both favoured moral legitimacy (congruence with social values) and cognitive legitimacy (comprehensibility and taken-for-grantedness) and disfavoured pragmatic legitimacy (self-benefits). This result does not necessarily indicate that the public does not see pragmatic values in CE schemes, rather than the pragmatic legitimacy is weaker and could be addressed through outreach and engagement activities.**

5.3.1. Social Expectations

Participants were asked if, before taking the survey, they had heard of the term ‘circular economy’. Across the two country samples, 34% overall responded ‘yes’, with 26% responding yes in the UK compared with 46% in Spain. There were also noticeable differences between age groups and, more specifically, between the youngest (18-24) and oldest age groups (65+). For the youngest age group, 41% responded yes, while it was 27% for the oldest age group. The highest level of awareness of the CE terminology was in the younger age groups in Spain (the highest level was 57% for 25-34 year-olds) and the lowest was among the oldest age group in the UK (Figure 9). A low level of awareness regarding CE has previously been observed in European contexts (Sijtsema et al., 2020) and other findings have suggested that a lack of public interest and awareness is a barrier to the advancement of the CE (Kirchherr et al., 2018).

The project leading to this application has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 869318

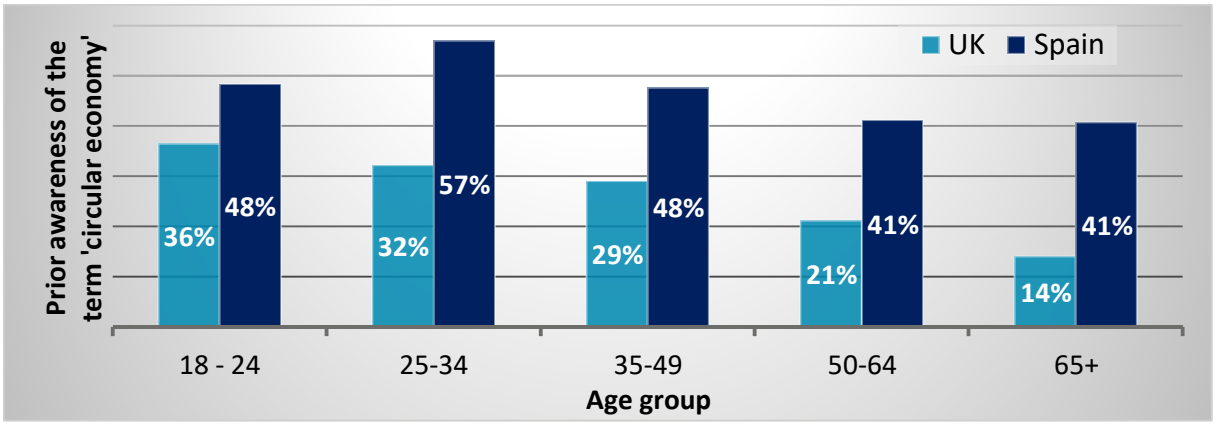

Figure 9 Prior awareness of the term 'circular economy'

In response to whether companies should be environmentally responsible, the average responses to all statements for both countries were 4 (agree) and above (Figure 10), with 84% either somewhat or strongly agreeing and only 6% disagreeing. For all of these statements, the level of agreement was higher for the Spanish sample compared to the UK sample, and this was statistically significant for combined measures of the six statements.

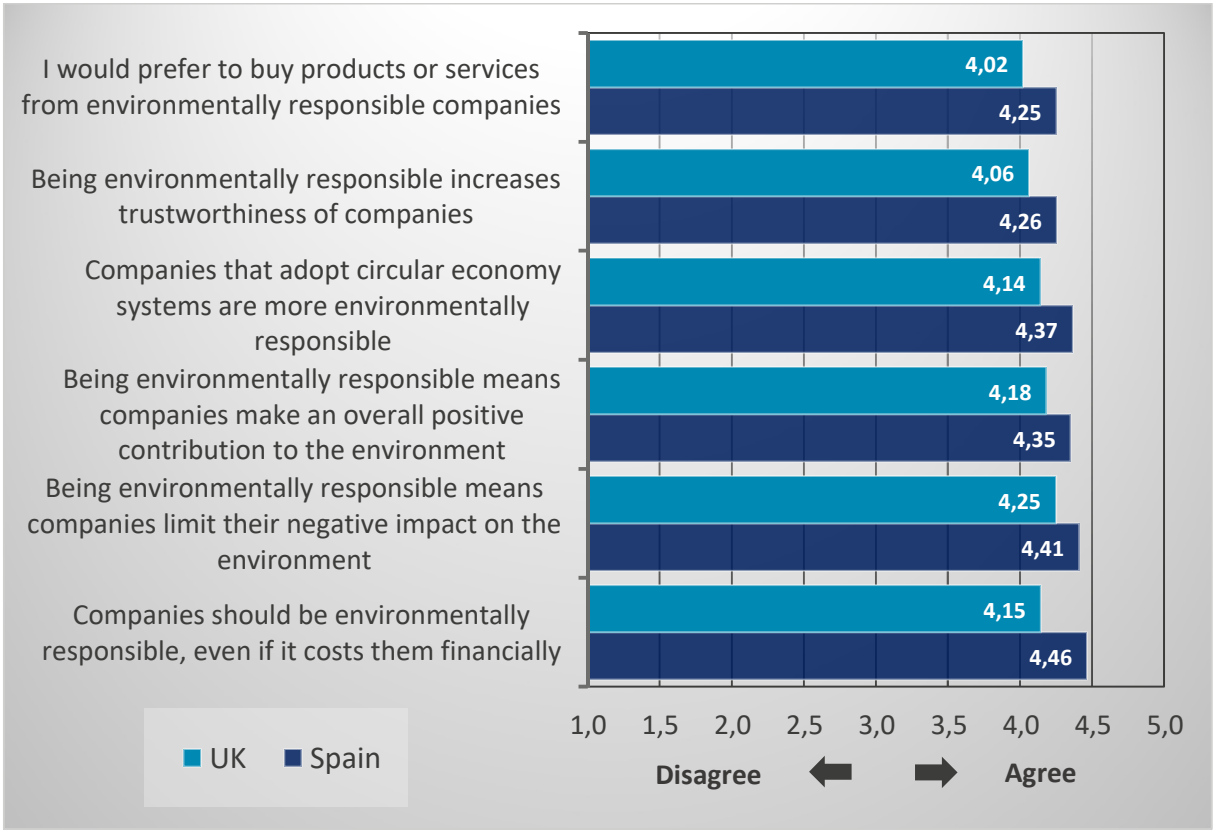

Figure 10 Expectations for environmental responsibility

In response to whether companies should be socially responsible, the pattern of responses was very similar to the environmental responsibility statements (Figure 11). That is, the average level of response corresponded with 'agree' (81% agreed and 7%

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

disagreed) and the average rating was slightly higher for the Spanish survey. In summary, the responses showed that the survey participants expected companies to be environmentally and socially responsible.

Previous Eurobarometer results have shown some differences between the UK and Spanish respondents, and between age groups across all European respondents for certain attitudes towards the environment. For example, Spanish respondents were more likely to say that changing the way we produce and trade is the most effective way of tackling environmental problems, and older respondents were less likely to support changing the way we consume (European Commission, 2020c). Further investigation of the difference between the two country samples may be warranted, however, some of the differences may be influenced by the methodology or demographics of the samples (for example, in line with the general population, the Spanish sample had a higher proportion of older respondents).

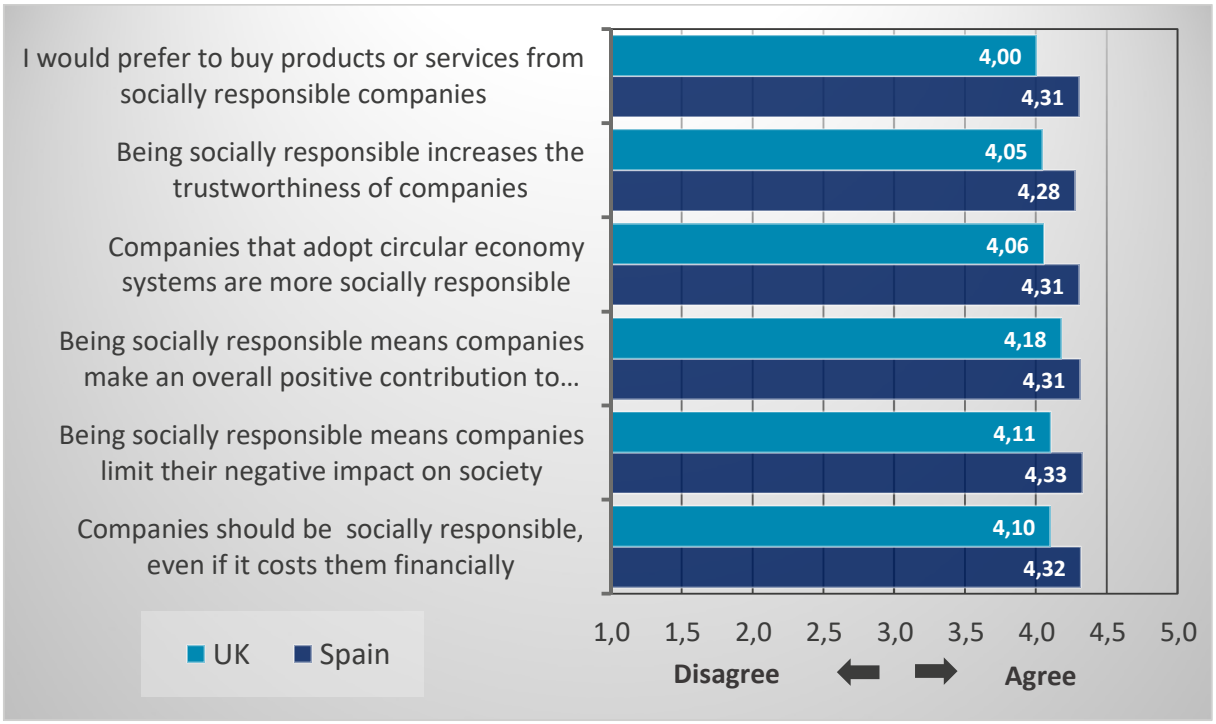

Figure 11 Expectations for social responsibility

In terms of government responsibilities, overall, most participants from both countries agreed that governments should (i) encourage companies to adopt CE systems, (ii) provide financial incentives and (iii) legally require companies to adopt CE systems. When asked if companies should only be expected to do what is in their financial interests, the overall response from both samples tended towards somewhat disagree, again supporting the CSR vision presented in section 3, that societies expect companies to do more socially and environmentally. Finally, another statement that deviated from the general pattern of responses in Figure 12 was *"I would pay a premium for products of services from companies with CE systems"*. The average response fell between 'neither agree nor disagree' and somewhat agree. This indicated that there was less appetite for paying a premium, however, there may be segments of the population willing to pay more – although behavioural research into CE in

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

European contexts has shown a gap between people's willingness to engage in CE practices and their actual (lower) engagement (LE Europe et al., 2018). Moreover, as the surveys were conducted during the coronavirus pandemic, some households may have felt more finically constrained, thus, such circumstances should be considered when reflecting on the results.

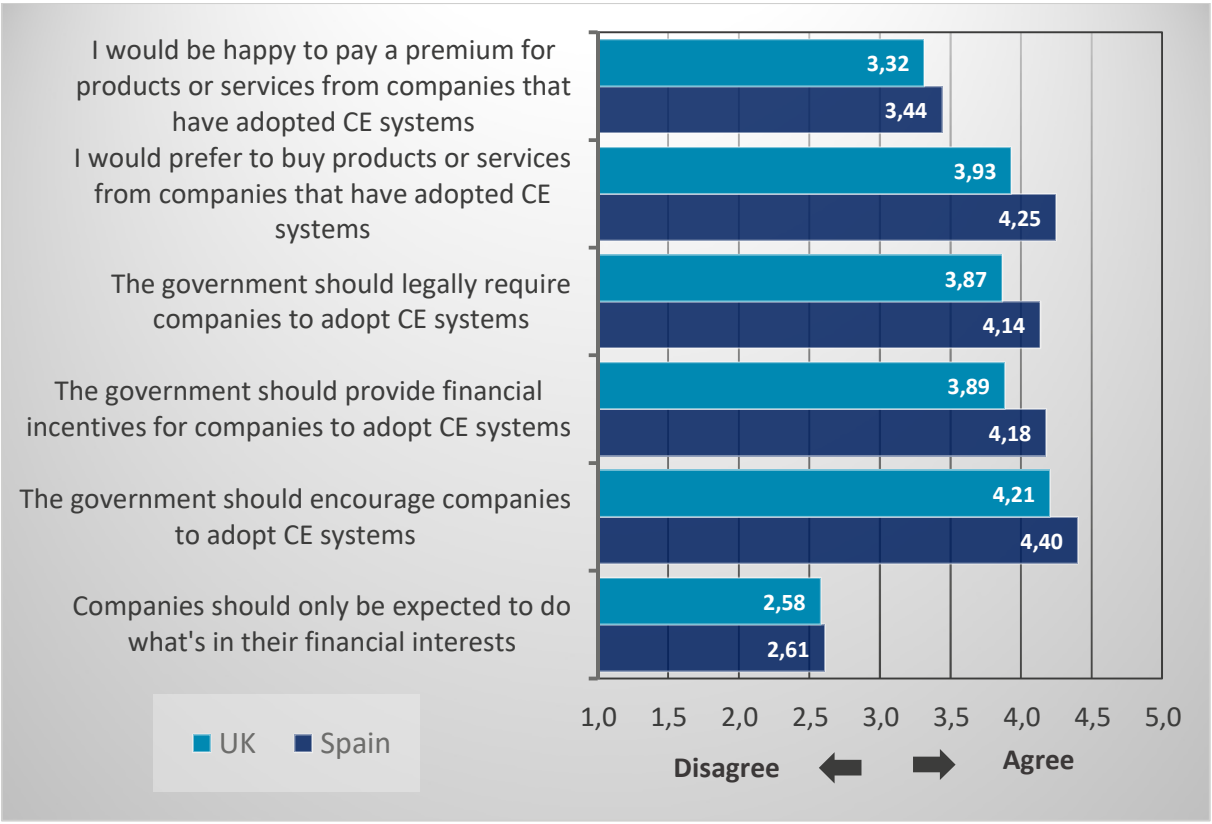

Figure 12 Preferences for CE projects and governance

5.3.2. Values perspectives

Four values perspectives were evaluated (biospheric, altruistic, hedonic and egoistic) using the standardised statements and typology developed for environmental research (Steg et al., 2014). Statements from each of the four values perspectives were compared in sets using a Best-Worst method with an average result of above zero indicating a stronger preference for that perspective. The results are summarised in Figure 13. The results showed that, overall, the survey participants aligned themselves most with the environmental (biospheric) and the social (altruistic) perspectives, thus reinforcing the findings from the agree-disagree statements, already discussed in the previous section, and the public expectations for social and environmental responsibility. The survey participants were least aligned with the egoistic perspective and the hedonic perspective was, on whole, relatively neutral across the three statements (with some variability).

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

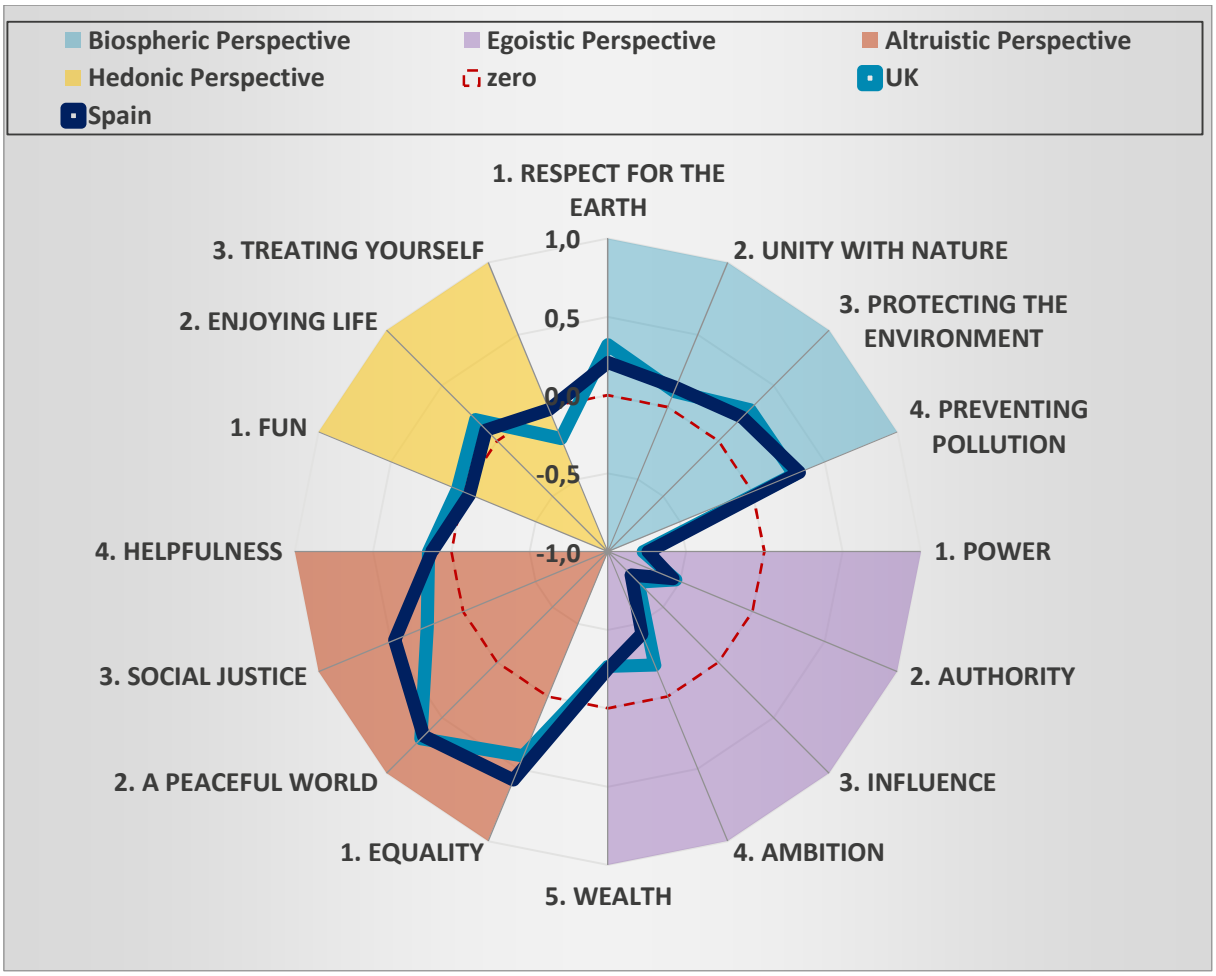

Figure 13 Summary of responses to the four 'values perspectives'

An observation to make is, firstly, that the four sets of comparisons used different, albeit theoretically grouped statement – there was no cross-comparison of the statements. As such, it was anticipated that the Best-Worst comparisons for each set of four statements would differ slightly, as the results showed. There were some notable differences between the two samples, Spanish respondents agreed less with Ambition and more with Treating themselves in the fourth comparison set when compared to the UK sample. The Spanish respondents also scored Equality and Social Justice higher than the respondents in the UK sample.

There was a statistical association between those who were more strongly aligned with both the environmental (biospheric) and the social (altruistic) perspectives, and preferences for products or services from companies with CE systems. The association between the environmental perspective and support for CE is unsurprising and reflects similar findings from related research (e.g. Bolderdijk et al., 2013). Moreover, the similarity between those aligned with altruistic values and environmental values is expected as their items are shown to be substantially correlated (Steg et al., 2014).

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

5.3.3. Legitimacy

Statements from each of the three legitimacy categories were compared in sets using a Best-Worst method. The results are summarised in Figure 14. Overall, respondents from the UK and Spain tended to agree more with moral legitimacy statements, followed by cognitive legitimacy statements and, lastly, pragmatic legitimacy statements.

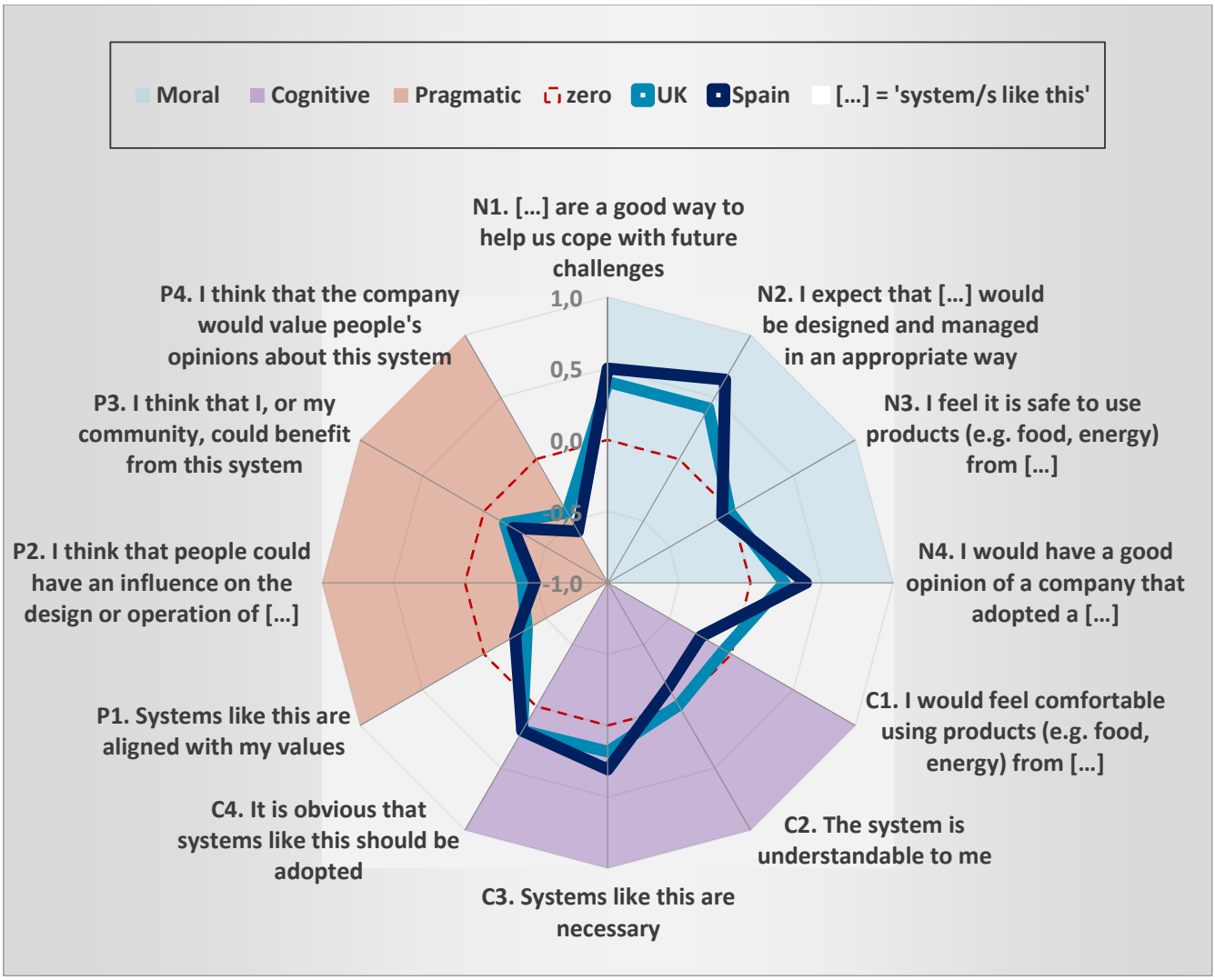

Figure 14 Summary of surveys results for the three legitimacy categories. […] abbreviates 'system/s like this' in the statements. N = Normative, C = Cognitive, P = Pragmatic.

Discrepancies were found within the three legitimacy categories. Although moral statements scored the highest, the statement "*I feel it is safe to use products (e.g., food, energy) from a system like this*" deviated from the general pattern of responses, highlighting the importance of safety concerns (e.g., bacteria, harmful chemical). Comprehensibility ("*The system is understandable to me*") and taken-for-grantedness ("*It is obvious that systems like this should be adopted*") formed distinctively two patterns of cognitive legitimacy, where comprehensibility scored lower than taken-for-grantedness. These results are particularly interesting as taken-for-grantedness is considered to be the most powerful and subtle source of legitimacy and usually

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

appears after understandability (Suchman, 1995). Of the three statements relating to pragmatic legitimacy, the statement "*I think that I, or my community, could benefit from this system*" scored the highest. This highlighted the awareness of potential benefits, but that outreach and engagement activities could help to enhance the perceived relevance of the other pragmatic legitimacy sub-categories. A reflection to be had is that the four sets of statements used theoretically different statements. Therefore, it was expected that the Best-Worst comparisons would be different within the same legitimacy category, as the results attested.

There were differences between the two country samples. Spanish respondents agreed more with two CSR related statements, "*I expect that systems like this would be designed and managed in an appropriate way*" and "*I would have a good opinion of a company that adopted a system like this*", although they agreed less with a third CSR related statement "*I think that the company would value people's opinions about this system*" when compared to the UK sample. This reinforced the observation made in section 3.2, that CSR can vary from one region to another. Spanish respondents felt less comfortable using products derived from the CE scheme ("*I would feel comfortable using products (e.g., food, energy) from systems like this*") and understood the CE scheme less ("*The system is understandable to me*") when compared to the UK sample.

For the follow-up interviews, illustrative examples of the results can be found in Table 2. These results highlighted drivers of transitioning towards the CE. Respondents saw value in the CE scheme, and it was positively evaluated as "brilliant" and as a "positive initiative", which contributed to moral legitimacy. The CE was seen to benefit consumers (e.g., price reduction), farmers (e.g., provision of local fertilisers) and the local community (e.g., local taxes reduction, employment opportunities), which reinforced pragmatic legitimacy. The adopting company had economic benefits (e.g., disposal costs reduction, income from fertilisers sale) and was positively valued by respondents as displaying ethical, responsible, forward-thinking values towards the environment and the society (pragmatic and moral legitimacy), and a competitive advantage (moral legitimacy). The latter reinforced the philanthropic and ethical responsibilities of the CSR concept described in section 3.2. Finally, it was also beneficial to the society and the environment (e.g., pollution and reliance on freshwater reduction), which reinforced moral legitimacy. When compared to other technologies such as solar panels or conventional energy production, the CE scheme was preferred (moral legitimacy).

Perceptions of cognitive legitimacy seemed to increase when respondents connected the CE scheme to: 21st century challenges (e.g., unsustainable production), de facto CE, respondents' common practices (e.g., buying whisky from a distillery providing heat to surrounding buildings), the natural environment and already legitimate CE practices (e.g., recycling). Finally, the CE scheme was perceived as inevitable, the only way to go forward and should be rolled out everywhere, which reinforced cognitive legitimacy. Respondents felt that recycled water could be reused (e.g., home heating, irrigation) instead of being discharged into the sea, and that companies have wastes that could be turned into resources.

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

Table 2 - Illustrative examples of the legitimacy categories from interviews

Legitimacy category	Illustrative examples from interviews
Pragmatic legitimacy	*"That thing [CE scheme] can flow and the different stages can benefit different people"* , interview 7
	"[…] talking to local politicians, local councils […] I don't think I have any direct [impact]" , interview 9
	"It does seem to be a rehash of the concept of greenwashing where companies do tend to try assume green credentials for their activities" , interview 3
Cognitive legitimacy	*"I assume I already am [eating vegetables grown with products derived from wastewater]"* , interview 3
	"[…] over the next 10 years […], it will probably become vital [CE schemes]" , interview 2
	"the CE is replicating what nature has done for many years" , interview 7
	"I hadn't heard about it [concept of the CE] before your initial survey" , interview 8
	"[…] it's an essential initiative" , interview 9
Moral legitimacy	*"[…] is it going to be completely pure and as good as the waters already in the ocean or into the coastal waters, or is it going to be somewhat contaminated food?",* interview 1
	"tax breaks for the companies, […] encourage them to do this", interview 9
	"There would have to be controls over this", interview 8

After reviewing the drivers of CE schemes, we identified challenges to a transition towards a CE. As was the case in the survey, some respondents were not aware of the CE before the interview, thus detracting from its legitimacy. Some respondents could not see any benefits to a CE scheme taking place in areas with ample freshwater supply or when comparing circular energy with traditional energy (pragmatic legitimacy). Some respondents expressed concerns over an increase in prices, thus a transition towards a CE could impact the social foundation of the UK or Spain. Few respondents felt that they could directly influence the development or the operation of the CE scheme other than voting for local representatives or buying products from circular companies, thus reinforcing the lack of pragmatic legitimacy. Some respondents associated the CE scheme with the concept of greenwashing, discussed in section 3.3 and questioned the "greenness" of the CE scheme if fertilisers were transported by trucks or boats (pragmatic legitimacy), thus reinforcing the need to be transparent on the contributions that such schemes make to the CE. The CE was not the preferred solution when compared to other ways of producing energy (windfarm and solar panels) and water (water abstraction in freshwater rich areas), thus challenging the moral legitimacy. Similar to the results of the survey statement "*I feel it is safe to use products (e.g., food, energy) from a system like this*", there was some concern with the safety of products derived from wastewater, thus weakening the moral legitimacy.

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

Results showed that respondent's expectations were linked to some of the identified challenges. When respondents were asked about how their perceptions of the CE scheme could be improved, they expected to receive information about (i) the advantages and disadvantages of the CE scheme as compared to a conventional one, (ii) the treatment processes and (iii) the benefits for today and tomorrow's society and the environment (pragmatic and moral legitimacy). Information was expected to be provided by schools, supermarkets, local governments, associations or distilleries, as such actors were believed to bridge the gap between the public and the adopting company. We add that the information could be provided to members of the public, farmers and consumers and could focus on how to help the society, its citizens and the environment in problematic areas and areas perceived to be rich in freshwater. Further, there is a need to address pragmatic legitimacy by directing outreach activities towards involving the public and providing them with the means to engage beyond buying circular products and voting.

To address greenwashing, respondents expected information about all the activities of the company (e.g., non-environmental activities, working conditions), thus reinforcing pragmatic legitimacy. To address safety concerns, it was expected from companies and regulatory bodies to ensure appropriate research, monitoring, maintenance, thus addressing moral legitimacy. Finally, it was expected from the governments to provide financial support to companies adopting CE schemes.

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

6. Conclusion

6.1. Main conclusion

In this white paper, we aimed to develop a better understanding of two intertwined aspects of the transformation towards a CE:

I. **Moral and ethical drivers and motivations for companies to adopt CE practices (with a particular focus on examples of WSIS)**
II. **Societal expectations regarding the adoption of such CE practices**

I. Moral and ethical drivers
Partners in ULTIMATE and other CE projects have a moral obligation to ensure, to the best of their ability, that they contribute to a sustainable CE. We present state-of-the-art research on environmental and social boundaries for a safe and just space for humanity to illustrate how a CE may not necessarily be sustainable. We point to where specific challenges might be, primarily concerning environmental boundaries but also by pointing to some social boundaries which are under pressure in two of ULTIMATE's demonstration case countries. Specifically, we invite partners and stakeholders to consider the following trade-offs and pitfalls related to moral-ethical premises that are often adopted but not fully considered when pursuing the CE:

- **A CE does not necessarily reduce the extraction of raw materials**
- **A CE does not necessarily imply a reduction in energy use**
- **A CE can even increase the consumption of materials**
- **A CE that contributes to environmental sustainability could reduce social sustainability**
- **Social indicators suggest that planning for CE requires particular considerations related to employment and democratic quality in Spain as well as issues of income inequality in the UK**

We summarise our recommendations in the following sub-section on how project partners (or stakeholders outside ULTIMATE in relevant projects and policy spheres) could enhance the sustainability of a CE, by refining or modifying a project or an approach (either *ex ante*, intermediate and *ex post)*.

The concept of CSR is used to address the moral legitimacy and organisational expressiveness of firms. In this white paper, we examined how firms can express their contributions to a CE as a manifestation of their CSR, but in a way that avoids the appearance of greenwashing. RRI is compulsory in most projects financed by the EU's H2020, including ULTIMATE. RRI implies that researchers, citizens, policymakers, business and third sector organizations work together throughout the research and innovation process to better align both the process and its outcomes with the values, needs and expectations of society. This promotion of RRI and its guiding principles can therefore act as another moral driver for companies and research to invest in public engagement and governance aspects of CE systems, particularly as part of their innovation processes. Moreover, novel governance or public engagement processes used in ULTIMATE may help inform future developments of RRI. Other dimensions of

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

the EC's RRI framework are addressed in other parts of ULTIMATE, including Deliverable D7.5.

II. Social Expectations

Extrapolating from survey data, we observe that not all citizens may be familiar with the term Circular Economy, however, they are likely to value its key concepts of reducing environmental impact through reuse, recycling and efficiency improvements. Accordingly, they may prefer products from environmentally friendly companies, think such companies are more trustworthy, responsible and appreciate companies investing in environmentally friendly or circular production chains. Most citizens are likely to expect companies to be environmentally and socially responsible and such expectations may form an important base for developing successful CSR strategies.

We explored how social expectations might provide a foundation for the legitimisation of CE systems. Through our analysis, we interpreted that the CE systems examined in the UK and Spain attracted higher perceptions of moral legitimacy (congruence with social norms) and cognitive legitimacy (comprehensibility and taken-for-grantedness), and lower perceptions of pragmatic (self-benefits) legitimacy. This was echoed in follow-up interviews, where participants' suggestions for how practices could be improved were predominantly associated with pragmatic legitimacy, highlighting the need for more public outreach and involvement activities. Because CE systems seem to be perceived overall as legitimate, companies that adopt CE systems may also have greater legitimacy in the eyes of their customers and wider society.

Our results show that many citizens are likely to think that governments should play a more active role in the transition to a CE either by (i) encouraging companies to adopt CE systems, (ii) providing financial incentives or (iii) legally requiring companies to adopt CE systems. Overall, however, support for governments to encourage companies to adopt such systems was stronger than support for the idea of providing financial incentives, or for direct regulation. Our results indicated that the willingness to deliberately choose circular products if they are more expensive was moderate, although there may be segments of the population willing to pay more. In other words, companies may not recoup much direct financial value (through increased sales or higher prices) from the positive perceptions that might result from CE system adoption.

Our results indicated that a more proactive steering role from public authorities to enhance corporate CE practices as the default option seems both desirable and legitimate. Research has shown a gap between many people's intentions and actual behaviour when it comes to purchasing more circular yet more expensive products (people will tend to favour price and convenience - LE Europe et al., 2018). Combining this knowledge with the empirical results presented in this report indicates a potential role for regulative oversight to help facilitate more ethical purchases and thus encourage CE practices.

6.2. Recommendations

General recommendations for practitioners, policymakers and researchers within and beyond the ULTIMATE project:

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

- **We recommend considering the possibility to enhance the environmental and social sustainability of the CE projects, by looking into the main sustainability challenges**
- **A sustainable CE project must relate to the main sustainability challenges at the regional level, but also connect to the global scale for instance by referring to the safe and just space framework**
- **Explanation of CSR should be done through transparent communication of both contributions and limitations**
- **Companies should plan for and count on being held accountable for their CE claims**
- **To minimise the risk of greenwashing, companies may provide a more transparent overview also of their non-circular activities**
- **Good governance processes should identify relevant stakeholders and the needs, demands and expectations they have**
- **Our results indicate that a more pro-active steering role from public authorities to enhance corporate CE practices as the default option seems both desirable and legitimate**
- **Companies may want to open discussions with governments (e.g. local, national) to discuss financial support for CE systems**

Outreach and engagement practices (WP3):

The cross-sectoral water-oriented living labs in WP3 aim to develop, test, and validate innovations not only from a market perspective but also in terms of societal acceptance and diffused benefit. Inclusive urban and regional governance can be greatly supported using the living labs model that facilitates the participation of the citizens in a co-design, co-implementation and co-monitoring development process. These living labs apply the quadruple helix approach to support interaction between academia, business, government, citizens and environmental interest groups to develop a new CE systemic optimum with new business models and innovative policies based on the true value of water as a societal advantage. Moral-ethical drivers and societal expectation related to water in the CE are fundamental in reaching these objectives. The following recommendations may benefit living lab deployment:

- **Outreach and engagement practitioners have to take into account that most people are not familiar with the term CE but do grasp its key principles**
- **A lack of pragmatic legitimacy may be addressed by shaping the outreach practices at three levels: (i) increasing the awareness of the CE and explaining the meaning of the concept, (ii) providing information about the CE benefits and (iii) giving the public concrete steps and actions towards direct involvement**
- **The information provided as part of outreach activities could be tailored to include how the CE can help society, its citizens and the environment in areas with different types of environmental challenges**
- **Outreach activities may want to emphasise communicating safety aspects to CE systems to alleviate any public concerns**
- **When recruiting citizens to be involved in CE practices, you may want to appeal to values of environment, sustainability and provide hands-on**

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

illustrative examples rather than framing it as CE because many citizens are not familiar with the terminology

6.3. Issues for reflection

The first part of this white paper arrives at specific issues for reflection, which can serve as moral and ethical drivers and motivations for companies to move towards more sustainable CE practices and perhaps help to reduce any propensity for greenwashing. The issues for reflections are gathered together here, with a headline referring to the name of the chapter where the theoretical framing and reasoning is presented and argued for:

Premise of a circular economy

- **Are there linear processes in the economy that if transformed into circular processes may lead to increased pressure on the ecological ceiling, indirectly or directly? If so, how can this be addressed, if not changed?**
- **Are there power structures among the stakeholders of the CE scheme that may slow down the transition from a linear to a sustainable CE, indirectly or directly? If so, how can this be addressed, if not changed?**
- **Are there costs of the CE transition that should be taken into account because they raise affordability issues for marginalised groups? What are these costs and which social groups are affected? How can this issue be addressed?**
- **Check specific societal challenges of the home country or region of the industrial symbiosis at hand. Which social factors are not satisfactory? Can you do something to increase positive contributions, and reduce potential negative effects through the undertaking of the CE scheme?**

Corporate Social Responsibility

- **Be aware of the difference between improvements in the core activity of a firm, and improvements in support systems or infrastructure;**
- **Be transparent about what kind of changes are induced with the CE scheme; firm-level improvements (incremental or substantial, core level or support systems), industrial level improvements, policy changes, or wider societal effects;**
- **Be explicit and transparent about preconditions on which the different improvements rest on. Who or what do you need for these preconditions to be fulfilled? Are there constraints at firm, industrial, policy, societal, local or global levels? Which factors does the project control, and which are outside the CE scheme's control?**
- **Discuss possible counteracting effects in terms of sustainability. This can be done by various tools; looking into the concept 'Do No Significant Harm', by addressing interlinkages of sustainable development goals - or by using models like those presented in figure 3 and 4.**

Responsible Research and Innovation

- **What are the relevant policy documents for your sphere, and are you working in line with the trend of these documents? Why, why not?**

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

- **Are there relevant policy opportunities or processes where you are not present? Should you participate, and at which level? Local, regional, national, EU, or, international for instance through relevant UN processes?**
- **Has your public engagement increased the likelihood that the CE scheme outcomes are more societally relevant and desirable?**
- **Can the CE scheme, through public engagement, foster a more scientifically literate society of knowledge-driven and empowered citizens?**

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

7. References

Binz, C., Harris-Lovett, S., Kiparsky, M., Sedlak, D. L., & Truffer, B. (2016). The thorny road to technology legitimisation - Institutional work for potable water reuse in California. Technological Forecasting and Social Change, 103, 249–263. https://doi.org/10.1016/j.techfore.2015.10.005

Bocken, N.M.P., de Pauw, I., Bakker, C., van der Grinten, B. (2016). Product design and business model strategies for a circular economy. Journal of Industrial and Production Engineering, 33:5, pp. 308-320

Bolderdijk, J. W., Gorsira, M., Keizer, K., & Steg, L. (2013). Values determine the (in)effectiveness of informational interventions in promoting pro-environmental behavior. PLoS ONE, 8(12), 1 – 7. https://doi.org/10.1371/journal.pone.0083911

Borup, M., Brown, N., Konrad, K., & Van Lente, H. (2006). The sociology of expectations in science and technology. Technology Analysis and Strategic Management, 18(3–4), 285–298. https://doi.org/10.1080/09537320600777002

Bouman, T., Steg, L., & Kiers, H. A. L. (2018). Measuring values in environmental research: A test of an environmental Portrait Value Questionnaire. Frontiers in Psychology, 9(APR), 1 – 15. https://doi.org/10.3389/fpsyg.2018.00564

Bowen (1953). Social responsibilities of the businessman. University of Iowa Press.

Brouwer, S., Pieron, M., Sjerps, R., & Etty, T. (2019). Perspectives beyond the meter: A Q-study for modern segmentation of drinking water customers. Water Policy, 21(6), 1224–1238. https://doi.org/10.2166/wp.2019.078

Brocklehurst, M., Appelqvist, B., Loureiro, A., Bartl, A., Kamuk, B., Velis, C., Crawford, G., Gilbert, J., Hulgaard, T. and Tisza, K. (2015). “Circular economy: trends and emerging ideas”, Report No. 2, Task Force on Resource Management, International Solid Waste Association, Vienna.

Brown R Ashley R and Farrelly M (2011). Political and Professional Agency Entrapment: An Agenda for Urban Water Research. Water Resources Management 25:4037- 4050

Brundtland, G.H. (1987). Our Common Future: Report of the World Commission on Environment and Development. Geneva, UN-Dokument A/42/427. http://www.un-documents.net/ocf-ov.htm

Carroll, A.B. (1991). “The Pyramid of Corporate Social Responsibility: Toward the Moral Management of Organizational Stakeholders”, Business Horizons

Carson, S.G., Nilsen, H.R. (2021). in Pereira, E.G., Spencer R. and Moses, J.W.(eds) ‘Sovereing Wealth Funds, Local Content Policies and CSR’, pp. 621-633.

The project leading to this application has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 869318

Council of the EU (2020). Position of the Council at first reading with a view to the adoption of a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on the establishment of a framework to facilitate sustainable investment, and amending Regulation (EU) 2019/2088 - Adopted by the Council on 15 April 2020. Downloaded February 2021 from: https://data.consilium.europa.eu/doc/document/ST-5639-2020-REV-2/en/pdf

Commission of the European Communities (2001). GREEN PAPER Promoting a European framework for Corporate Social Responsibility, Brussels, 18.7.2001 Retrieved May 2021 from: https://www.europarl.europa.eu/meetdocs/committees/deve/20020122/com(2001)366_en.pdf

Derraik, J. G. B. (2002). The pollution of the marine environment by plastic debris: A review. Marine Pollution Bulletin, 44, 842 – 852.

Dreyer, M., Chefneux, L., Goldberg, A., Von Heimburg, J., Patrignani, N., Schofield, M. and Shilling, C., (2017). Responsible innovation: A complementary view from industry with proposals for bridging different perspectives. Sustainability, 9(10), p.1719.

Elkington, J. (2018). 25 Years Ago I Coined the Phrase "Triple Bottom Line." Here's Why It's Time to Rethink It. Harvard Business Review. https://hbr.org/2018/06/25-years-ago-i-coined-the-phrase-triple-bottom-line-heres-why-im-giving-up-on-it

EU Technical expert group on sustainable finance (2020). Financing a sustainable European economy. Taxonomy Report: Technical Annex. Updated methodology & Updated Technical Screening Criteria, March 2020. Downloaded March 2021 from: https://ec.europa.eu/info/files/200309-sustainable-finance-teg-final-report-taxonomy-annexes_en

European Union (2008). "DIRECTIVE 2008/98/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 19 November 2008 on waste and repealing certain Directives (Text with EEA relevance)", available at: https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:312:0003:0030:EN:PDF

European Union (2012). Responsible Research and Innovation: Europe's ability to respond to societal challenges. Retrieved from https://ec.europa.eu/research/swafs/pdf/pub_public_engagement/respo nsible-research-and-innovation-leafet_en.pdf. Accessed 1 Sept 2017

European Commission (2015). "Closing the loop – an EU action plan for the circular economy", COM (2015) 0614 final, available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=15470 34538027&uri=CELEX:52015DC0614

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

European Commission (2019). The European Green Deal, press release 11 December 2019. Accessed online at: https://ec.europa.eu/commission/presscorner/detail/en/ip_19_6691

European Commission (2020a). Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. A new Circular Economy Action Plan. Available online: https://ec.europa.eu/environment/circular-economy/ (Accessed 7-04-2021)

European Commission. (2020b). Science with and for Society in Horizon 2020, Accessed February 2021 from:
https://ec.europa.eu/programmes/horizon2020/en/h2020-section/science-and-society

European Commission. (2020c). Special Eurobarometer 501 Attitudes of Europeans towards the Environment.

European Commission (2021), "Horizon 2020. Public engagement and responsible research and innovation", Accessed February 2021 from: https://ec.europa.eu/programmes/horizon2020/node/766

European Parliament (2020). 'Circular economy: definition, importance and benefits'. Downloaded February 2021 from https://www.europarl.europa.eu/news/en/headlines/economy/20151201STO05603/circular-economy-definition-importance-and-benefits

Folke, C., Biggs, R., Norström, A.V., Reyers, B. and Rockström, J. (2016). "Social-ecological resilience and biosphere-based sustainability science", Ecology and Society, Vol. 21 No. 3, Article No. 41, available at: http://dx.doi.org/10.5751/ES-08748-210341

Geels FW (2006). Co-evolutionary and multi-level dynamics in transitions: the transformation of aviation systems and the shift from propeller to turbojet (1930-1970). Technovation 26:999-1016

Geels FW, Schot J (2007). Typology of sociotechnical transition pathways. Research Policy 36:399–417

Geissdoerfer, M., Savaget, P., Bocken, N. M. P., & Hultink, E. J. (2017). The Circular Economy – A new sustainability paradigm? Journal of Cleaner Production, 143(April 2018), 757–768. https://doi.org/10.1016/j.jclepro.2016.12.048

Ghisellini P, Cialani C, Ulgiati S (2016). A review on circular economy: the expected transition to a balanced interplay of environmental and economic systems. Journal of Cleaner Production, 114:11-32

Hammond JS, Keely RL, Raiffa H (1998). Hidden traps in decision making. Harv Bus Rev 76:47–58

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

Harris-Lovett, S., Binz, C., Sedlak, D., Kiparsky, M., & Truffer, B. (2015). Beyond User Acceptance: A Legitimacy Framework for Potable Water Reuse in California. Environmental Science and Technology, 49(13), 7552–7561. https://doi.org/10.1021/acs.est.5b00504

Inigo, E.A. and Blok, V., (2019). Strengthening the socio-ethical foundations of the circular economy: Lessons from responsible research and innovation. Journal of cleaner production, 233, pp.280-291.

Kirchherr, J., Piscicelli, L., Bour, R., Kostense-Smit, E., Muller, J., Huibrechtse-Truijens, A., & Hekkert, M. (2018). Barriers to the Circular Economy: Evidence From the European Union (EU). Ecological Economics, 150(April), 264–272. https://doi.org/10.1016/j.ecolecon.2018.04.028

Koelmans AA, Nor NHM, Hermsen E, Kooi M, Minting SM, De France J (2019). Mircoplastics in freshwaters and drinking water: Critical review and assessment of data quality. Water Research 155:410-422

Koop SHA and Leeuwen CJ (2017). The challenges of water, waste and climate change in cities. Environment, Development and Sustainability 19:385-418

Korhonen, J., Honkasalo, A. and Seppälä, J. (2018). "Circular economy: the concept and its limitations", Ecological Economics, Vol. 143, pp. 37-46

Lazarevic, D., & Valve, H. (2017). Narrating expectations for the circular economy: Towards a common and contested European transition. Energy Research and Social Science, 31(May), 60–69. https://doi.org/10.1016/j.erss.2017.05.006

LE Europe, VVA, Ipsos, ConPolicy, & Trinomics. (2018). Behavioural Study on Consumers' Engagement in the Circular Economy. papers2://publication/uuid/F8BF4E2C-FB2C-4BC7-B7C3-E31CA2CCACF8

Matten, D., & Moon, J. (2008). 'Implicit' and 'explicit' CSR: A conceptual framework for a comparative understanding of corporate social responsibility. Academy of Management Review, 33(2), 404–424.

Nilsen, H.R. (2008). "Carbon capture and storage in the light of circulation economics", International Journal of Social Economics, Vol 35, No. 1-2, p. 111-124

Nilsen, H.R. (2019). "The hierarchy of resource use for a sustainable circular economy." International Journal of Social Economics Vol. 47 No. 1, 2020 pp. 27-40

Nilsen, H.R. (2020). "Staying within planetary boundaries as a premise for sustainability. On the responsibility to address counteracting sustainable development goals." Nordic Journal of Applied Ethics, 14 (1), pp. 29- 44. http://dx.doi.org/10.5324/eip.v14i1.2863

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

Norwegian Ministry of Climate and Environment (2017). "Klima- og miljødepartmentets prioriterte EU/ EØS-saker 2017", available at: https://www.regjeringen.no/contentassets/6ac58373253a49d18b079bbc3b45887b/prioriterte_eu_eos_saker_2017_kld.pdf

O'Neill, D.W., Fanning, A.L., Lamb, W.F., and Steinberger, J.K. (2018). A good life for all within planetary boundaries. *Nature Sustainability* 1, 88-95. doi: 10.1038/s41893-018-0021-4.

OECD. (2011). Water governance in OECD countries: A multi-level approach. Paris: Organization for Economic Cooperation and Development.

Padilla-Rivera, A., Russo-Garrido, S., & Merveille, N. (2020). Addressing the social aspects of a circular economy: A systematic literature review. Sustainability (Switzerland), 12(19), 1–17. https://doi.org/10.3390/SU12197912

Pansera, M., Genovese, A. and Ripa, M., (2021). Politicising Circular Economy: what can we learn from Responsible Innovation?. Journal of Responsible Innovation, pp.1-7.

Raworth, K. (2017). Doughnut Economics: Seven Ways to Tink Like a 21st-Century Economist. Random House, London, 2017.

Rockström, J., Steffen, W., Noone, K., Persson, Å., Chapin, F.S. III, Lambin, E., Lenton, T.M., Scheffer, M., Folke, C., Schellnhuber, H., Nykvist, B., De Wit, C.A., Hughes, T., van der Leeuw, S., Rodhe, H., Sörlin, S., Snyder, P.K., Costanza, R., Svedin, U., Falkenmark, M., Karlberg, L., Corell, R.W., Fabry, V.J., Hansen, J., Walker, B., Liverman, D., Richardson, K., Crutzen, P. and Foley, J. (2009), "Planetary boundaries: exploring the safe operating space for humanity", Ecology and Society, Vol. 14 No. 2, Article No. 32

Scott, R. W. (1995). Institutions and Organizations (P. Frost, A. S. Huff, B. Schneider, & M. S. Taylor, Eds.). SAGE.

Sijtsema, S. J., Snoek, H. M., van Haaster-de Winter, M. A., & Dagevos, H. (2020). Let's talk about circular economy: A qualitative exploration of consumer perceptions. Sustainability (Switzerland), 12(1). https://doi.org/10.3390/su12010286

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

Steffen, W., Richardson, K., Rockström, J., Cornell, S.E., Fetzer, I., Bennett, E.M., Biggs, R., Carpenter, S.R., de Vries, W., de Wit, C.A., Folke, C., Gerten, D., Heinke, J., Mace, G.M., Persson, L.M., Ramanathan, V., Reyers, B. and Sörlin, S. (2015). "Planetary boundaries: guiding human development on a changing planet", Science, Vol. 347 No. 6223, 11p., available at: http://dx.doi.org/10.1126/science.1259855 (accessed March 2018).

Steg, L., Perlaviciute, G., van der Werff, E., & Lurvink, J. (2014). The Significance of Hedonic Values for Environmentally Relevant Attitudes, Preferences, and Actions. Environment and Behavior, 46(2), 163 – 192. https://doi.org/10.1177/0013916512454730

Stahel, W. R. (2013). Policy for material efficiency – Sustainable taxation as a departure from the throwaway society. Philosophical Transactions of the Royal Society A: Mathematical Physical and Engineering Sciences, 371:0567

Strand R., Rommetveit K. (2019). Super MoRRI – Scientific understanding and provision of an enhanced and robust monitoring system for RRI, Task 1.1 Concept Note. Project website: www.super-morri.eu

Su B, Heshmati A, Geng Y, Yu X (2013). A review of the circular economy in China: Moving from rhetoric to implementation. Journal of Cleaner Production 42:215-227

Suchman, M. C. (1995). Managing Legitimacy : Strategic and Insitutional Approaches. Academy of Management Review, 20(3), 571–610. Retrieved from http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.108.2768&rep=rep1&type=pdf

Thorseth, M. and Schuppert, F. (2018). Governance towards a green future, in Düwell, M., Bos, G. and van Steenbergen, N. (eds), 'Towards the ethics of a green future', chapter 10, pp. 167-190. Routledge Studies in Sustainability, Taylor and Francis, http://library.oapen.org/handle/20.500.12657/24071

Van Ewijk, S. and Stegemann, J.A. (2016). "Limitations of the waste hierarchy for achieving absolute reductions in material throughput", Journal of Cleaner Production, Vol. 132, pp. 122-128.

Velis, C., Coronado, M. and Lerpiniere, D. (2015). "Circular economy: closing the loops", Task Force Report No. 3, technical report, International Solid Waste Association, Vienna, doi: 10.13140/RG.2.1.3232.0485.

Von Schomberg, R. (2012). Prospects for Technology Assessment in a framework of responsible research and innovation. in: Technikfolgen abschätzen lehren: Bildungspotenziale transdisziplinärer Methode, P.39-61, Wiesbaden: Springer VS

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

UNESCO (2015). United Nations Educational, Scientific and Cultural Organization. World Water Assessment Programme (WWAP). The United Nations World Water Development Report 2015: Water for a Sustainable World; UNESCO: Paris, France. Available online: http://unesdoc.unesco.org/images/0023/002318/231823E.pdf (accessed on 7-04-2021)

UNESCO (2017). United Nations Educational, Scientific and Cultural Organization. The United Nations World Water Development Report 2017. Wastewater the Untapped Resource; UNESCO: Paris, France, 2017; Available online: http://unesdoc.unesco.org/images/0024/002471/247153e.pdf (Accessed 7-04-2021).

Williams, I. (2015), “Forty years of the waste hierarchy”, Waste Management, Vol. 40, pp. 1-2

Zarfl, C., Fleet, D., Fries, E., Galgani, F., Gerdts, G., Hanke, G., & Matthies, M. (2011). Microplastics in oceans. Marine Pollution Bulletin, 62, 1589 – 1591.

2030 Water Resources Group. Charting Our Water Future. Economic Frameworks to Inform Decision-Making; 2030 Water Resources Group: West Perth, NY, USA, 2009; p. 5. Available online: http://www.2030wrg.org/wp-content/uploads/2014/07/Charting-Our-Water-Future-Final.pdf (accessed 7-04-2021)

The project leading to this application has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 869318