

## D4.2.: Policy recommendations and strategy to reindustrialise Europe



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## List of acronyms / abbreviations used in this document

Acronym / abbreviation	Definition
AM	Advanced Manufacturing
CE	Circular Economy
CPS	Cyber Physical Systems
EC	European Commission
EEE	Electric and electronic Equipment
EFSI	European Fund for Strategic Investments
EISCE	EU Industrialization Scoreboard in a Circular Economy
ELV	End-of-life vehicles
EPR	Extended Producer Responsibility
ESIF	European Structural and Investment Fund
EV	Electric vehicle
EU	European Union
GHG	Greenhouse Gas
ICT	Information and Communication Technologies
IoT	Internet of Things
IPCEI	Important Projects of Common Interest
JIIP	Joint Institute for Innovation Policy
LCA	Life-cycle Assessment
R&D	Research and Development
RoHS	Restriction of Hazardous Substances
RTDI	Research, Technology Development and Innovation
SRL	Societal Readiness Levels
TCO	Total Cost of Ownership
TRL	Technology Readiness Level
USP	Unique Selling Point
VAT	Value-added tax
WEEE	Waste Electrical and Electronic Equipment

## Executive summary

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The eighteen months-work performed in FUTURING culminates in this document that on the first place, imagines a renovated and competitive European industry that has succeeded in the Fourth Industrial Revolution while making a decisive move towards the CE. This shift has been mainly motivated by the business opportunities untapped by an increasing and steady demand for circular products and services of an empowered and educated society. The industry we have imagined is able to bring together economic, social and environmental gains.

### PRODUCING AND CONSUMING RESPONSIBLY

*“The European industry is prepared to **respond to the needs of citizens that consume responsibly**. Its competitiveness and innovation is built upon **complex global value network management** and **business models based on Circular Economy principles**, as well as on the opportunities that **industrial digital transformation** and the **convergence of novel technologies** offer. European industry contributes to **fair value creation**, relies on a **highly-skilled workforce** and its **sustainable, resource-efficient production model** is a **worldwide reference**”*

Secondly, this document describes the foundations and enablers of such a systemic and far reaching transformation:

Public authorities setting right boundary conditions and a CE-stimulating framework: Public authorities can facilitate the transition to circular value creation systems by following a mission-orientation approach, which means, amongst others, the establishment of clear goals and a target date to achieve them, mobilisation of significant public and/or private resources, and the employment of a mix of policy measures. This entails innovating the financing models to meet the CE needs and increasing the available public funding, setting the example and buying circular products and services at all levels of public spending, the establishment of a stimulating framework for consumers and producers to adapt their production and consumption patterns, etc. All this needs to come along with effective information and education campaigns (see the “Educating for a circular future” enabler below.) and with other mechanisms to help consumers with making good decisions according to their preferences.

Science and technology enabling CE: Public support to emerging and advanced technology enablers that enhance competitiveness of the European manufacturing industry in a more sustainable and responsible manner can de-risk those innovations and attract private funding. The opportunities offered by the technologies assimilated to the 4<sup>th</sup> industrial revolution on the way to transitioning to circular value creation systems are noticeable. Taking the whole product life cycle into account, companies can provide new value adding services which e.g. help the customers or users to use the physical product as long as possible (e.g. using predictive maintenance) with the highest performance (e.g. with software updates or exchanging spare parts) and the lowest environmental impact (e.g. resource efficiency services).

Educating for a circular future: Education has been widely regarded by the stakeholders consulted in FUTURING as being crucial to strive a CE. It offers tremendous potential to change business and consumer behaviour, and hence, transform the consumption and production patterns (across industries and actors/stakeholders). However, even the benefits are critical, they are usually unleashed in the longer run, so accelerated efforts are recommended. Therefore, education measures need to be accompanied by market and fiscal incentives both for the consumers and the industry in order to make sure that it pays-off to be sustainable, as well as by sound regulation measures.

Transitioning to a circular value creation system: Industry stakeholders and entrepreneurs play the decisive role in transforming the European industry towards a circular value creation system. It is the economic aspect of making profit that is the entrepreneurial incentive and the key driving force for the transition towards a CE. Thus, circular value creation systems and business models should not be in contrast to, but favour businesses' competitiveness. In that context, public authorities could strongly facilitate the transformation of the European Industry towards a circular value creation system e.g. with joint actions in public-private partnerships, incentives to go circular, or regulation.

Thirdly, it proposes a set of policy recommendations that are shown in the following table:

Policy setting the right boundary conditions and a CE-stimulating framework	<b>PR1: Mission-oriented policy making towards the CE</b>
	<b>PR2: Public administration leads the change through circular public procurement</b>
	<b>PR3: Innovate financing models to meet the CE needs</b>
	<b>PR4: Harmonised CE regulation and standards</b>
	<b>PR5: Empower consumers to adopt sustainable lifestyles</b>
ST enabling a CE	<b>PR6: Focus public support on emerging and advanced technology enablers</b>
	<b>PR7: Reinforce the value creation approach in ST: Demonstrate capacity to shift to a CE</b>
	<b>PR8: Promote and incentivise new ways of developing and delivering new technologies</b>
Educating for a circular future	<b>PR9: Society awareness – Educate consumers to create sustainable lifestyles</b>
	<b>PR10: Industry awareness to drive changes in value creation and supply chains</b>
	<b>PR11: Transformation of the education and training system</b>
Transitioning to a circular value creation system	<b>PR12: Financial incentives for eco-design, sustainable production and circular business models</b>
	<b>PR13: Legislative framework facilitating the transition to a circular value creation system</b>
	<b>PR14: Support the articulation of regional/local closed loops...</b>

FUTURING partners involved in this task have built upon the previous deliverables, went through the roadmaps of relevant PPPs, investigated the most significant previous research outcomes and studies, examined CE strategies and roadmaps in various frontrunning countries, and reviewed the most significant EU policies, communications and directives to imagine the future EU industry in the circular economy context. A range of diverse stakeholders reviewed and adjusted the vision outlined by the project partners, and contributed significantly to the elaboration of the policy recommendations.

## 1 Introduction

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### 1.1 Aim of the deliverable

This deliverable reports the work performed in Task 4.2 “Shaping the strategy to reindustrialise Europe” within the context of Work Package 4 “Strategy to support EU Reindustrialization”. The task started on 1st June 2017 (M10) and ended on the 28th of February 2018 (M18). The task and the corresponding deliverable (D4.2) is the result of the collaborative work of LMS, TECNALIA, COTEC, EFFRA, A.SPIRE, CEA, FESTO, INESC-TEC and TNO and builds upon the outcomes achieved throughout the FUTURING project in its various stages. It incorporates the findings of other WPs and experts’ feedback to issue a set of policy recommendations on how to reindustrialise Europe within the framework of the Circular Economy (CE).

This deliverable stands for two main objectives. On the one hand, it proposes a holistic and forward-looking vision for Europe’s next generation industry, under the title “Future European industry producing and consuming responsibly”. The stepwise vision-scoping process is exhaustively described in D4.1. Chapter 3.1 in this document captures the vision-statement and describes its main elements. On the other hand, it describes how policy should intervene to make the aforementioned vision a reality. Those policy recommendations are mainly addressed to European institutions, but also underline the need for translating them into national and local pathways. In fact, a stronger, smarter and more circular industry is a joint venture<sup>1</sup> of European institutions, EU countries, regions and industry, but also R&D organisations, educational institutions and society at large. The building blocks that structured our work throughout the project underlie the different categories of policy-recommendations, which have been formulated to be self-explanatory in terms of the goal pursued and the type of actors they are targeted at, and expressed in a roadmap that illustrates when the outcomes of each type of intervention can be expected.

### 1.2 Working methodology

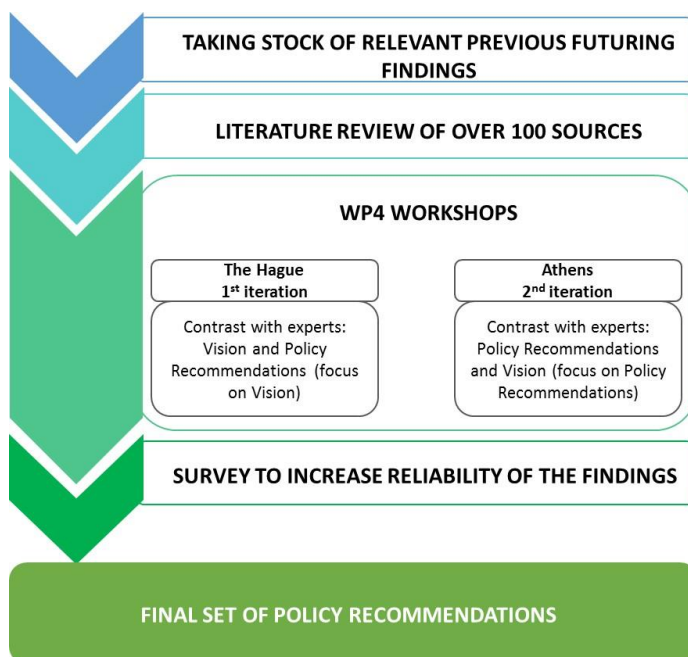
The exercise of shaping the strategy to reindustrialise Europe performed in Task 4.2 was designed to capture the findings of the previous WPs, the outcomes of an extensive literature review and the opinion of a wide range of stakeholders and experts in various fields that underpin the kind of industry and society that FUTURING is claiming for. Likewise, it was aimed at serving the ultimate goal of drafting a set of recommendations for policy makers to figure out how they can foster and facilitate such a shift.

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<sup>1</sup> Vice-President Jyrki Katainen’s speech at the EU Industry Day 2018 underlined that the success of the industrial policy in Europe is a joint venture among EU countries, regions, European institutions, and above all, on the active role of industry itself.



**Figure 1 Task 4.2 working methodology**



Source: Own elaboration

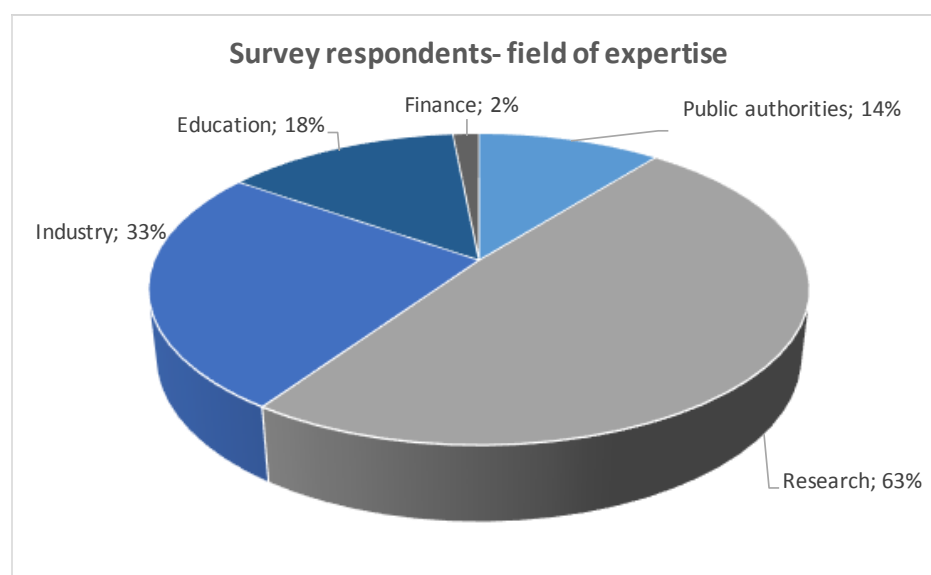
**First**, the outcomes of previous tasks were examined, in order to isolate the most relevant findings, key messages and evidences that could help us shape the policy recommendations. This entailed revisiting different deliverables produced with the FUTURING project and reviewing the most relevant findings of the literature review conducted in Task 4.1.

**Second**, we started to shape a vision-statement for the European industry, and elaborated a first sketch of the policy recommendations. Both the draft vision and the policy recommendations were presented and discussed with eight external experts representing both the industry, R&D and public side in a workshop held in The Hague in October 2017. The panel of experts consisted of key representatives from research and industrial related organizations with multidisciplinary skills related to several aspects of circular economy, such as background and experience on regulatory framework and policy incentivisation, environmental sustainability, social and economic aspects. Although the focus of this first workshop was on the discussion and agreement upon the vision statement, interesting insights for the policy recommendations were also obtained. The outcomes of this workshop laid the ground for further work on the vision-statement and the policy recommendations. A second workshop took place in Athens in December 2017, where the vision statement was slightly adjusted and the adequateness of the policy recommendations discussed, paying attention to the timeline for the implementation of the different measures, as well as the expected impact. Seven experts participated in the Athens' workshop, who combined diverse expertise on related to circular economy aspects, such as digitalization aspect, regulatory framework and policy incentivisation, economic aspect, National and regional initiatives for innovation in KET's and particular requirements for SME's to uptake circular economy models. This consultation process, along with a working session among the WP4 participants, led to a list of fourteen policy recommendations grouped under four categories. The information collected from the experts in these workshops, alongside with data

collection processes involved in different project activities, was/were compliant with the data protection guidelines formulated together with FUTURING's Data Protection Officer as reported in the respective deliverables D7.1 and D7.2.

**Third**, we conducted an on-line survey with the aim of validating the final set of policy recommendations and gathering information to express them in a roadmap. The survey was sent out to all the experts and stakeholders that had been involved in the different stages of the FUTURING project and spread to the networks of all consortium partners. This wide dissemination effort allowed us to gather 101 responses which fed into the policy recommendations that are described later on in this document. The policy recommendations were well accepted by the respondents (see Figure 2 for more information about the type of actors consulted), who provided interesting insights to express the recommendations in a roadmap and elaborate the messages to be issued to the target stakeholders.

**Figure 2 Field of expertise of survey respondents**



Source: Own elaboration

## 2 What's going on to reinforce the European industry.

### 2.1 Diagnosis of the European industry

European Industry is the **backbone of the European economy** - producing 80% of Europe's exports, accounting for 80% of private Research, Technology Development and Innovation (RTDI) expenditures, and providing more than 30 million jobs with additional 70 million in related sectors - and thus is substantially contributing to job and wealth creation in Europe (Sautter, 2016). At the same time, European industry is undergoing a paradigm shift with new challenges and opportunities. After a longer period of "de-industrialisation", culminating in the economic crisis ten years ago, European industry recovered and gains again in importance. In particular, in the context of the **4th industrial revolution** European industry could grow strong again and strengthen its leading global position. However, there are several challenges and uncertainties such as e.g. increasing nationalism and

protectionism (e.g. "America First") or high investments from new international players (e.g. "Made in China 2025" or acquisition of leading European companies) which could accelerate fierce competition going up the value chain.

So, **there is a need to increase and to sustain the industrial basis and competitiveness of Europe**. The **Circular Economy** (CE) approach could be at the core of a competitive, sustainable and resilient European industry, while fighting against climate change. There are several forms in which the CE can play a strong role to face the climate change challenge. We mention here the three most salient forms. First, reducing, reusing and recycling consumer and durable goods, reduce emissions of waste management operations (sorting, transport, energy recovery, landfill, etc.) and avoid GHG emissions. Second, longer lifetime for products optimises embedded materials and energy in durable and consumer goods. Longer lifetime of products still an under used strategy as this is at odds with increasing speed of products replacement due to rapid innovation in consumer goods. In principle longer lifetime in products reduces waste management operations and reduces energy needed in the production of new products. Third, CE strategies embedded directly in production, either remanufacture or industrial processes cut GHG by reducing the amount of energy required of primary raw materials transformation into usable products and derived services.

European companies from all sectors are looking for **opportunities to deploy CE principles and to eco-innovate in a way that they deliver value for the overall society**. Shift to renewable sourcing, modular design, servitization, recycling and reuse are all the key words that altogether shape the pillar actions of CE are being deployed within companies, especially within industrial companies. Joint efforts and increased investments from public and private side (e.g. in the form of public-private partnerships) are needed, to advance the transformation of the European industry towards a CE. Even if the CE approach may appear as a rather young idea in European policies, the FUTURING project found several examples showing that CE ideas are already discussed and implemented within European industry and civil society.

Europe exhibits a **sound position** within the world community in order to change its industry with regards to circularity, while still having a long road ahead. For example, Europe is a world leader in green technology development, but it seems that many technologies are employed for green innovations outside the European market. Some other regions, and in particular China, are heavily investing in green technologies such as renewable energy technologies. In future, Europe could lose its role as a vanguard of green industry and CE.

Yet, there are a number of **key challenges ahead** for the European industry on the road to a CE. Some of the most relevant ones are listed below (FUTURING, D2.3.):

- finding new CE-related business models which are successful on the European market,
- re-organising multi-faceted value creation processes along complex supply chains and product life cycles. In this regard, open questions are e.g. how to use digital technologies to increase the transparency of material and energy flows, how to assess the impact of various supply chains and product life cycles, or how to find the right balance between privacy aspects and deployment of open data practices.

- changing mind-sets and helping people (consumers, manager, policy-makers, etc.) with making good decisions according to their preferences and regarding a reduction of negative environmental impact and an increase of positive socio-economic impact,
- capitalising on the technological competitive advantage of European industries to experience circularisation as an opportunity. Enabling technologies need to be developed, demonstrated as performant and competitive, and widely deployed. Digitalization and connectivity may be of interest here, as well as works on materials, bio-sourcing, process integration and tens of technological improvements that cope with eco-design criteria and deliver lifecycle benefits for environment, communities and economy, and
- overcoming regulatory barriers, with concerns such as the status of waste, lack of homogeneity between EU Member states, fossil regulations failing to be holistically consistent or illegal practices insufficiently addressed by authorities.

## 2.2 Policy context

The urgency to reindustrialise Europe is addressed in many policy papers (as well as in numerous studies). The next generation industry is normally regarded as being **smart, innovative and sustainable** (in addition to competitive), which means connecting economic, societal and environmental gains, while unleashing the potential of a **digitised industry**. Likewise, socioeconomic implications of reindustrialisation of Europe are gaining significance in the latest policy discourse of European authorities. Actually, the Juncker Commission's 10 policy priorities underpin amongst others, the willingness of the EC to **sustain the next generation EU industry on digital and CE parameters**, is aimed to enhance **EU industry's sustainability and competitiveness**, to foster **sustainable economic growth**, as well as to **generate new jobs** and contribute towards **social integration and cohesion**. To achieve these objectives, the policy priorities point at preserving resources, assistance for businesses to make and export clean products and services, the creation of local low-an and high-skilled jobs. **"Making Europe's economy more inclusive, competitive, resilient and future-proof"** is also at the heart of the European Commission's white paper on the future of Europe (European Commission, 2017) and the related reflection papers<sup>2</sup>. These implications are also reflected in the broader concerns addressed by the UN's SDG.s, particularly under "SDG9 Industry, Innovation and Infrastructure" and "SDG12 Responsible production and consumption", and the "European Action for Sustainability" (European Commission, 2016). Next, a brief description of EU policy landscape examines the approach and orientation in the fields of industrial, Research and Innovation (R&I), and the environmental policy, which already include measures such as tax harmonisation or the promotion of sustainable finance to better orient private capital flows to sustainable investments. The policy recommendations in Chapter 4 emphasise and broaden some of these measures.

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<sup>2</sup> [https://ec.europa.eu/commission/white-paper-future-europe/white-paper-future-europe-way-ahead\\_en](https://ec.europa.eu/commission/white-paper-future-europe/white-paper-future-europe-way-ahead_en)

## EU Industrial Policy

The industrial policy strategy at EU level<sup>3</sup> aims to enable EU industry to take advantage of the global megatrends and lead the way. It intends to create the best framework conditions to empower and strengthen industry's ability to adapt and innovate, and hence, reap the opportunities of industrial transformation. According to Vice-President Katainen, “this is how we build the necessary resilience to come out strong from global competition, also on the longer term”.

The strategy relies heavily on the Commission's key policy priorities: the investment plan, the capital markets union, the energy union, digital single market and single market strategies and open, rules-based trade. It offers a holistic and ambitious approach to industry, formulating a strategy towards a smart innovative and sustainable industry contributing to competitiveness, jobs and growth.

The strategy provides a point of reference for a coherent approach in the design, development and implementation of policies and regulation but it also stresses the active role of the industry itself for achieving the goals set by the strategy. Combining both existing and new horizontal and sector-specific initiatives, the strategy addresses different issues and relates to several of the ten priorities of the Juncker Commission. The focus areas of the strategy are the deepening on the European Single Market; the digital transformation of the industry; the capitalisation of Europe's leadership in a low-carbon and CE; stimulating more capital investment for innovation of the European industry; supporting industrial innovation on the ground; promoting an open and rules-based international trade; and finally, strengthening the partnership with Members States, regions, cities and the private sector in order to materialise the strategy.

Regarding the focus area “capitalisation of Europe's leadership in a low-carbon and circular economy”, it is worth mentioning the Commission's strategy on sustainable finance to better orient private capital flows to more sustainable investments. According to the Commission, the differentiation between sustainable and other investments is essential to integrate wider risks and returns into long-term investment decisions and increase the confidence in projects' implementation, disclosures and labels.

## EU Research & Innovation (R&I) policy

Innovation Union (IU) is the current EU-level strategy to create an innovation-friendly environment that makes it easier for great ideas to be turned into products and services<sup>4</sup>. The IU targets are implemented by the on-going European Framework Programme for Research and Innovation, Horizon 2020, which sets research excellence, societal challenges and competitiveness of European industry as core priorities<sup>5</sup>. Research and technology development activities related to CE are addressed under the H2020 Societal Challenge "Climate Action, Environment, Resource Efficiency and Raw Materials" area, but also in calls related to Leadership of European Industry (LEIT).

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<sup>3</sup> The renewed EU industry policy strategy was released in 2017

<sup>4</sup> <http://ec.europa.eu/research/innovation-union/index.cfm>

<sup>5</sup> <https://ec.europa.eu/programmes/horizon2020/>

To reinforce the role of European R&I policy as a tool to address societal challenges and lead Europe to innovation spurred growth, mission-orientation has emerged to policy-making agendas as a potential approach to target part of the European R&I funding to limited number of large-scale initiatives (European Commission, 2017a). Mission-oriented policy can be defined as “systemic public policies that draw on frontier knowledge to attain specific goals”. Mission-oriented initiatives can be characterised as follows (Mazzucato, 2018):

- Typically arising from a need or urgency to tackle a (societal) problem and taking clearly-defined approaches to address the challenges.
- Mission-oriented R&I policies show clear directionality and intentionality of the target setting and implementation, differentiating them from other challenge-led R&I policies;
- Mobilising – in a coordinated manner – various resources, actors and tools within a certain timeframe, characterised by complex, systemic, cross-technology, cross-industry, cross-border and cross-policy activities.

This new potential direction of EU R&I policy can be seen as an attractive logical step from the challenge driven approach in H2020 towards clear direction setting and solution orientation in FP9. Mission-oriented R&I policy can be considered especially attractive in terms of solving the complex, multi-faced societal challenges. This requires attention to the ways in which technology and innovation interacts with socio-economic issues, and how public policy (not R&I policy alone) can best reinforce the entire value chain, including citizens to become active part of the solution. A mission-driven approach can be critical also for the competitiveness of European industry. Compared to other major economies like the US or China, the European R&I system is less centralised and shows a more diverse landscape. The mission-orientation could be seen as a tool to set common vision, mitigate the fragmentation and to unleash the potential of European common market.

It is also a complex approach, with many pitfalls and potential downsides, especially at EU level, that requires careful analysis and consideration of how the direct involvement of all stakeholders, across disciplines, across sectors, across policy domains and across governance levels (EU, national, regional and urban) is orchestrated.

Mission-oriented R&I policy and the endeavors to enhance the competitiveness of the European manufacturing industry in a more sustainable and responsible manner are not contradictory strategies. On the contrary, the tentative mission-orientation of European R&I policy could at best address how to reindustrialise Europe within the framework of the CE.

### **The Circular Economy Package**

The EU has a broad regulatory framework related to the environment and climate change. Past EU regulations address discrete aspects of the Circular Economy (CE)<sup>6</sup>. The CE new package reflects lessons learned in several streams of policymaking and its focus addresses issues product design,

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<sup>6</sup> The policy areas surveyed include Climate, Energy, Circular Economy, Pollution, Consumer Protection, Product Safety, Single Market and other Environmental Horizontal Policies (Deliverable 3.1).



production processes, consumption and waste management. The CE package puts priorities in plastics, food waste, critical raw materials, construction and demolition, biomass and bio-based products, it calls for systemic and transformative innovation and links its aims and actions to mainstream innovation policy in Europe. This alignment includes the application of instruments currently available (e.g., access to finance, new skills, public-private partnerships and public procurement). Furthermore, as the actions proposed are to be taken forward with the principles of Better Regulation, the CE initiative requires coordination with several areas of European policy and regulation, for example consumer protection and the single market regulation. Related with the advent of new digital technologies, so far most policies, not only those related to the CE but also those related to the digitalization of industry are focusing on input policies (higher end research, tech transfer, IP) or development policies (SMEs, R&D subsidies, fiscal policy, clusters, networks, platforms and procurement). There is a lesser effort on looking into the challenges to provide not only upscaling means but also to provide stability to the new markets and new value chains created. In the forthcoming years it will be necessary to support the CE with policies oriented to underpin standardization, trade, employment and above all competition.

### 3 A holistic and forward-looking vision for the European industry

This chapter starts with imagining a brighter future for the European industry and tells a story that unveils a clean, smart and innovative industry that creates value for all Europeans. Next, it displays the vision statement for the EU industry, followed by a description of its main components. The vision statement uncovers the far-reaching transformation that the EU industry has to undergo, which entails teaming up of all the stakeholders, and a firm leadership from public authorities.

#### 3.1 A glimpse into a brighter future: A clean, smart and innovative industry for all Europeans

*Imagine a world with a marvellous and cool industry... It creates value for us, both as citizens and consumers, while promoting sustainable values in society. We love our industries because they fulfil the needs of our personal, family, community and work lifes, with products and services technology savvy, at the pace of the planet. We, as consumers, have been learning from some time now, how frugality is the best way of life, demanding for the best, but just when we really need it. No more, no less, not before, nor later.*

*We love our industries because we are able to participate in the design of our needs and because it's easy to replace, return, and dispose our products. They keep us informed about our carbon footprint, suggesting us new ways to save time and energy, making us aware of the life-cycle of the products and services we use, and how they are created in a global or local value chain. We are able to continuously assess how resource-efficient and sustainable our industries are.*

*All this is possible because our industrial world is "co-acting on symbiosis", meaning that circular economy (CE) is realized to a large extent, by its successful implementation not only within single enterprises, but also within enterprises ecosystems in a collaborative way, leading to an increase of industrial symbiosis. Fully integrated value chains through collaborative platforms are supporting this. State-of-the-art and emerging production technologies are the cornerstone, as well as information which flows in highly interconnected devices, machines, factories, people. Symbiosis is also happening between people and machines, factories are human-centred although highly relying on artificial intelligence.*

*This world is also possible because CE implementation is enabled by consistent sets of policies and regulations, that also guide technological advances. CE became a widespread reality achieved through multiple education and awareness efforts, that resulted in a shift in consumer mindset, behaviour and increase in manufacturing and ecology oriented skills.*

*A corollary of this scenario is an increase in qualified employment and quality of working life, balanced consumption patterns and noticeable improvements in manufacturing carbon footprint.*

### 3.2 “Future European industry producing and consuming responsibly”

The vision statement below unveils a full swing in the adoption of the CE (see D3.2.). It describes a future scenario in which a decisive move has been made from industry, urged by an increasing and steady demand for circular products and services of an empowered and educated society. This shift has been enabled by a highly committed public sector, based on shared incentives.

#### PRODUCING AND CONSUMING RESPONSIBLY

*“The European industry is prepared to **respond to the needs of citizens that consume responsibly**. Its competitiveness and innovation is built upon **complex global value network management** and **business models based on Circular Economy principles**, as well as on the opportunities that **industrial digital transformation** and the **convergence of novel technologies** offer. European industry contributes to **fair value creation**, relies on a **highly-skilled workforce** and its **sustainable, resource-efficient production model** is a **worldwide reference**”*

With the transition towards a more circular oriented economy, the European industry aims at building a **globally leading, interconnected and adaptive socio-technical value creation system** that ensures **sustainable economic growth** and **social welfare**, well balanced in a resource-constrained world. Pivotal goals are to enhance global competitiveness of the European industry – providing the basis for sustainable economic development and social welfare to the benefit of the general public – and at the same time to reduce the negative impact of value creation such as consumption of non-renewable resources, loss of energy, waste of material, etc.



The development and broad implementation of resource and energy efficient production technologies and value creation processes, which respond to the **societal needs** (e.g. customized and “fair” products, decent and “fair” working conditions, etc.) and have the potential to **increase the competitiveness and resilience of the European economy** in various ways, as shown by a couple of examples in Table 1:

**Table 1 Examples of potential to increase the competitiveness and resilience of the European Economy**

Example 1 – backshoring of production to Europe: The broad introduction of circular value streams and regionalized product life cycles can contribute to “backshoring” of production to Europe (e.g. consumer products “Made in Europe” produced in high-performance urban factories close to the consumers)<sup>7</sup> leading to higher business success, new jobs and reduced CO2 emissions (due to shortened transport) as well as reduced dependence from global resources.

Example 2 – Circular value creation as Unique Selling Point (USP): Another example are the European competences in designing, engineering and managing complex circular value creation processes, which could serve as a worldwide reference and a Unique Selling Point (USP) on global markets, helping to export also engineering and consulting services (e.g. “Designed in Europe”) to the world.

The CE means rethinking the production and consumption methods. In this regard, digital technologies and the shift towards a **digitised industry** are often seen as an enabler for the deployment and operationalization of the systemic change required for the CE. Digitisation and new technologies can contribute and empower the implementation of circular business models. Digitisation of operations and advances in additive manufacturing, automation, and robotization of activities can contribute to material and energy efficiencies, as well as more efficient, accurate, and local organisation of processes. IoT (Internet of Things) and data analytics have the potential to improve product development and performance, enable tracking and monitoring of products to optimize maintenance, and provide data on the individual parts and their condition to determine whether recycling and remanufacturing strategies can be applied.

These enablers for the CE are well acknowledged. The two policies – the move towards CE and the digitisation of the industry – can, and should be developed as complimentary. The CE paradigm shift can benefit from the experience of upscaling advanced digital technologies in Europe and the Digital economy can contribute from the purpose and momentum created by the CE model. Table 2 provides some indicative examples of how digitalization of manufacturing can contribute to the transition towards a CE.

**Table 2 Digitalization of manufacturing and the Circular Economy – Indicative examples**

Cross-industry networks of multiple supply chains have evolved in the CE model using approaches such as industrial and urban symbiosis. For example, main elements -yet indicative- of the digital

<sup>7</sup> The high-tech production of shoes from Adidas in the Speedfactories close to the customers could serve as one example.

transformation which may support the approach to CE are cloud computing, embedded systems (CPS – Cyber Physical Systems) and the concept of smart factory:

Cloud Computing provides data, services and business models via internet. It thus depicts a platform for running software services and storing data without using storage capacity of a personal computer for every application, which is in turn a prerequisite for the Internet of Things. Through cloud computing and related applications such as big data, real-time data, and apps, many services from the real, physical world are shifted to a virtual one. This may save, for example, distances, resource usage and thus CO2 emissions.

Cyber Physical Systems - CPS involve smart products in addition to the basic networking of people, machines and products. The networking of sensors, actuators, etc., is the basis for expanding applications and thus a basic component for the circularity of resource use. It is the basic prerequisite for data collection, which in turn enables data analysis, the discovery of potentials and the increase of transparency.

A fundamental goal of digitization is to create intelligent value networks. These consist of intelligent, digitally networked production systems that enable a self-organized production, the so called "smart factory". Herein, machines, systems, logistics and products communicate and cooperate directly with each other as well as with humans. Production and logistics processes across the industrial enterprise are intelligently linked to each other in order to sustain production in terms of efficiency and flexibility. Tailored instructions for the worker reduces failures and rejects eventually resulting to more efficient material utilization and maintenance. Thus, assistance systems can contribute to the saving of raw materials, energy resources and ecosystem services (waste).

**A highly skilled workforce and a society educated on CE parameters** are undoubtedly **crucial factors** in transforming the EU industry in those parameters. New job profiles and skills requirements will emerge. They will be related not only to sustainable, recycling, remanufacturing, eco-design, but also to system-thinking, circular business models and complex-value networks, etc. all this powered by digital. skills. CE awareness will be embedded in primary and secondary school curricula to drive changes in the long run of current consumption patterns; the skill gaps and shortage addressed in lifelong learning programmes; and harmonised qualification systems will be developed for the new job profiles, so as to facilitate students' and workers' mobility.

### 3.3 An all-encompassing transformation

The industry we are imagining entails a systemic change in order to “harness the power of a myriad of individuals across the world in shaping our future through directed and mindful technological innovation” (G-STIC conference, 2017). To enable a new conception of growth and the socioecological transition of our society and economy, new approaches are required from multiple stakeholders

(CARAYANNIS et al 2010 and 2012)<sup>8</sup>: Direction setting, through right boundary conditions and a stimulating framework, is the main task attributed to **public authorities** at all levels; R&D organisations provide the relevant scientific and technological know-how; the **industry** produces in a circular value creation system; and the **society** follows CE principles. Those features are used to structure our policy recommendations later on in this document.

### **Policy setting the right boundary conditions and a CE stimulating framework**

The European Commission and other public authorities have already launched different initiatives to promote the transition from a linear economy to a circular one. These range from strategies such as the “Dutch programme for a Circular Economy” (Government of The Netherlands, 2016) or the “Making Things Last - A Circular Economy Strategy for Scotland” (Scottish Government, 2016) to EPR schemes, the EcoDesign Directive (European Commission, 2009) and the legislative proposals under the Circular Economy Package. Such measures need to be systematically evaluated, and if positive overall impact is evident, reinforced, broadened (to other types of products, to other countries), and in particular transnationally standardised and harmonised to reach different spheres in circularity of the European economy and society. The real benefits of such initiatives are still to be fully revealed and there is still a long way to go. OECD (2016) notes that while EPR schemes have helped to reduce landfilling and increase recycling, they have had limited effects on promoting eco-design. Likewise, one of the clearest messages delivered by the different stakeholders in the consultations made in FUTURING points at the market not being informed, committed, or empowered enough to adopt CE products and services (beyond the sharing economy initiatives). Of course, this is closely related to other factors like the cost competitiveness of products produced and delivered under linear economy parameters, the society not being aware enough about the risks of the linear economy, etc.

If an increasing and steady market for CE products and services is to be achieved, if the European industry’s competitiveness on global markets is going to rely on the broad introduction of circular value streams, regionalised product life-cycles (with lower CO<sub>2</sub> emissions due to the shortened transport, as well as reduced dependence from global resources), or the European competences in designing, engineering and managing complex circular value creation processes, highly committed public authorities are required to establish clear goals and work firmly to achieve them (e.g. through the incorporation mission-orientation approach into policy-making or the establishment of adequate regulatory settings). For an accelerated start, they could also lead the change by increasing circular public procurement, embed CE across different policy fields, innovate financing models to meet the CE needs. Shortly, the right boundary conditions and a stimulating framework for CE products and services have to be set. One of the cornerstones to stimulate the demand for CE products and services is to empower the citizens to ensure that it pays off to be sustainable. This can be done through market incentives such as tax deductions, cheap loans or tax-reliefs to invest in costly items (short-term impact

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<sup>8</sup> Carayannis et al. 2010 and 2012 propose a “quintuple innovation model approach”, where the society and the natural environment – in addition to the “triple helix actors” from university, industry and government – are seen as drivers for knowledge production and innovation, defining opportunities for the necessary socioecological transition of our society and economy in the 21<sup>st</sup> century.

measures), but also through firmly advocating for informing and educating the society on CE parameters.

### **Science and technology enabling circular economy**

An evidence-based assessment of advanced technologies within the context of CE has been performed in FUTURING deliverable D2.4 “List of Advanced Industry Enablers in the circular economy”, based on the study of results from already implemented technologies in various EU projects. The identified technologies have been assessed by the use of eight circularity criteria related to the Resolve framework pillar actions. The assessed technologies were further evaluated from the holistic point of view of CE, i.e. Planet, People and Profit. A list with the ten most relevant -to the concepts of CE- advanced technological enablers has been produced and it is shown in Table 3. The enabling technologies have been identified with high potential for re-industrialisation within the context of CE. It is perceived that the most promising are technologies related to collecting, dismantling, sorting and recycling processes (that explicitly materialize the three main “Re” in CE, i.e. Recycling, Reuse and Remanufacturing) and especially increasing the automation level of these processes. Following this technology, ICT related technologies together with control and automation technologies that belong to the Industry 4.0 show significant potential to simultaneously satisfy the three sustainability pillars.

**Table 3. Assessment of the identified technologies<sup>9</sup>**

Circularity criteria		Energy Efficiency	Material efficiency	Less waste	Less emissions	More safety	Higher flexibility	Sustainable product	Customizable product
Identified technologies	Technologies for “self-assembly”	••	••	•			•••	••	•••
	Innovative micro/nano-manufacturing processes	•••	•••	••		••	•••	•••	•••
	Additive manufacturing	••	•••	•••		•	•••	••	•••
	Flexible Sheet-to-Sheet (S2S) and Roll-to-Roll (R2R)	••	••	•••	••	••	•	••	•
	Innovative physical, chemical and physicochemical processes	•••	•••	••			•••	•••	•••
	Integration of non-conventional technologies and conventional technologies	•••	•••	••			••	••	••
	Methods for handling of parts, metrology and inspection	•••	•••	••			•••	•••	•••
	Photonics-based materials processing technologies	•••	•••	•••	••	••	•••	••	••
	Collecting, dismantling, sorting and recycling processes		•••	•••		••	•••	•••	•••
	Shaping technology for difficult to shape materials	•••	•••	•••	•••	••	•••	•••	•••
	ICT solutions for factory floor and physical world inclusion	•••	•••	•••	•••	•••	•••	•••	•••
	ICT solutions for modelling, simulation and management tools	•••	•••	•••	•••	•••	•••	•••	•••
	Control technologies, Robots and Automation	•••	•••	•••	•••	•••	•••	•••	•••
	Process Intensification	•••	•••	•••	•••	••	••	••	••
	ICT solutions for Product Life Management	••	••	••	••	•	•••	•••	•••

<sup>9</sup> High relevance (•••), Medium relevance (••), Low relevance (•) with respect to the corresponding criterion for circularity

## **Educating for a circular future**

The shift towards a CE would require far-reaching changes in policy, business owners, employers and the public (Social and Economic Council, 2017). For the CE to achieve a full uptake, a number of technological, regulatory and market barriers still need to be overcome. But the lack of internal and external (customer) education and awareness has to be addressed as well (FUTURING, D2.3.; ECOFYS, n.d.). The need to inform consumers and businesses about what the CE is, what it means for them, and what are the different business models has therefore been incorporated as a recommendation in previous research (European Commission, 2014).

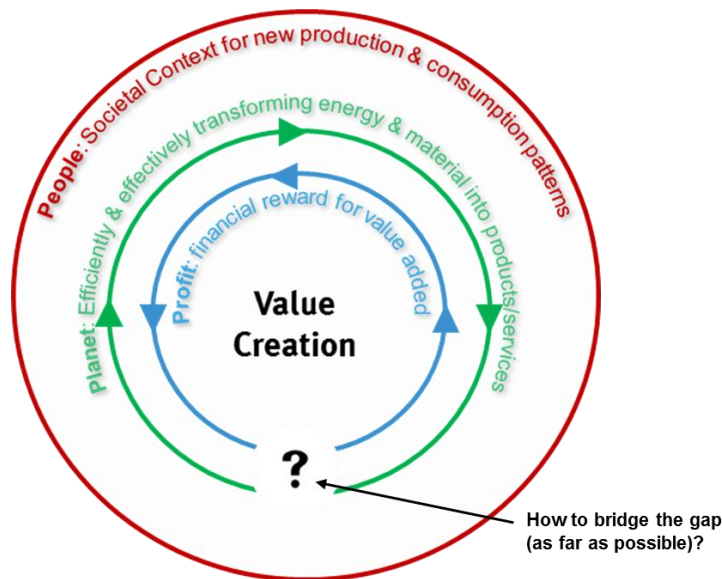
When it comes to new skills needed and prediction regarding the labour market in the CE, the need for new skills has been pointed out by different bodies. The European Parliament (2016) has noted the likely need for “technical skills which are currently not present in the workforce. Skills would for instance enable businesses to design products with circularity in mind, and to engage in reuse, refurbishment and recycling.” While the CE is still a relatively new subject in education (Government of The Netherlands, 2016), one can expect some progress, as this issue has been recognized by organizations such as the Ellen MacArthur Foundation.

Circle Economy and EHERO (2016) developed an approach to define and measure the amount of circular jobs, differentiating between directly circular jobs in sectors that follow core and enabling CE strategies and indirectly circular jobs in sectors that support directly circular jobs. Based on their approach, the study found currently only a small percentage of about 8.1% of Dutch jobs are currently circular. The Government of The Netherlands (2016) already indicated an intention to embed the CE firmly in education. Within FUTURING, Deliverable 3.1 has identified a number of skills which will be needed to support EU reindustrialization within the CE. These range from skilled workers and highly-skilled engineering roles, digital skills, systems skills, AM engineering skills, etc.

## **Transitioning to a circular value creation system**

According to the first Circularity Gap Report (Circle Economy, 2018), our world economy is only 9.1% circular, leaving a massive ‘Circularity Gap’ with regard to material and energy flows. However, the CE approach from FUTURING does not only refer to these ecological aspects but to all three aspects of the triple bottom line framework for sustainable development (FUTURING, D1.1.):

**Figure 3 Circular Economy with regard to the three “Ps” of the triple bottom line framework**



Triple Bottom Line Framework:

- **Planet:** Efficient & effective use of natural resources minimizing the ecological footprint of production & consumption
- **People:** fair & beneficial business practices toward labour and the community and region in which a corporation conducts its business
- **Profit:** following economic principles, profit is the entrepreneurial incentive for value creation

*Source: Own elaboration (based on FUTURING, D1.1)*

This holistic understanding of CE reflects the complexity of value creation processes and highlights the human aspect in these processes and respective ecosystems. It is the daily decision-making of the people which influences the production and consumption patterns as well as the broad societal context, in which the value creation processes are embedded. Thus, **economic success in future depends on addressing properly the economic, ecological and social challenges within a complex and interrelated system.**

Regarding resource consumption (energy and material consumption) along the product life cycle, the linear “take – make – dispose” model will be increasingly challenged by more circular business models, which strive for increased resource productivity (reduced waste and pollution by design or intention), and which aims to keep products, components and materials at their highest utility and value at all times. Transition to a more CE requires **changes throughout value chains**, from product design to new business and market models, from new ways of turning waste into a resource to new modes of consumer behaviour. This implies full systemic change, and innovation not only in technologies, but also in organisation, society, finance methods and policies. In that context it is important to admit, that even in a highly CE there will remain some element of linearity as virgin resources are required and residual waste is disposed of.

Supply chains are a key unit of action for implementing circular value streams. In its most extreme manifestation, the global economy is a massive conveyor belt of material and energy from resource-rich countries to the current manufacturing powerhouse China, and then on to destination markets in Europe and America where materials are deposited or—to a limited degree—recycled. This is the opposite of a loop. The materials leakage points and barriers to mainstreaming the new model of circular material flows in a globalized economy must now be addressed and overcome (WEF et al



2014). According to MANUFUTURE 2030 vision<sup>10</sup>, in future we will see – depending on products and industry sectors –several complex value creation networks (from regional to globally integrated networks) at the same time. In this context, the **regionalisation of value streams** for consumer products (e.g. clothing, shoes, etc. manufactured in high-performance factories close to the customers) could tremendously reduce the global footprint (due to shortened transport) and at the same time increase the socio-economic impact for Europe (new jobs, higher business success, etc.). For the introduction of regional product life-cycles in the context and related to the electrification of machines (e.g. electric cars) heavy investments in the infrastructure and ecosystems are needed from public and private stakeholders in order to facilitate the regional recycling, remanufacturing/refurbishment and reuse of components (batteries, etc.).

Regarding our holistic CE approach, the assessment of future supply chains and product life cycles has to integrate economic, ecological and social/ethical aspects<sup>11</sup>, reflecting also the increasing awareness of Corporate Responsibility as a means to assume the industry's social responsibility and to enter into a path of ecological, social and economic sustainable development.

## 4 Acting together to reach the vision: Policy recommendations

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According to the FUTURING vision of a future European industry, **it is the productivity and competitiveness of the European industry which has to be sustained and improved** in order to provide also in the future the basis for sustainable economic development and social welfare to the benefit of the general public. In this respect, the challenge of reducing the negative impact of value creation such as consumption of non-renewable resources, loss of energy, waste of material, etc. has to be tackled in a way that in the end the European industry has increased its productivity and competitiveness. Thus, **sustainable and circular business models should not be in contrast to, but in favour of global competitiveness.**

Bearing this context in mind, this chapter describes the policy recommendations under each of the four categories described in the previous chapter. Although the policy recommendations are mainly addressed to EU authorities, it is also important that they are brought into national and regional agendas. It is equally important that the rest of the stakeholders embark on the transformation. (See Table 4).

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<sup>10</sup> The MANUFUTURE 2030 Vision document of the European Technology Platform „ManuFuture“ will be shortly published.

<sup>11</sup> Examples are the Sustainability Reporting Standards of the Global Reporting Initiative or the Sedex Members Ethical Trade Audit



**Table 4 Policy Recommendations: Building blocks and target actors**

		RELATED BUILDING BLOCK							TARGET ACTORS					
		Policy & Finance	Science & Tech.	Business & Innov.	Education & Training	Human & Society	Environmental resp.	European Commission	Other public auth.	Private financing	R&D institutions	Industry	Educational inst.	Society
Policy setting the right boundary conditions and a CE-stimulating framework	PR1: Mission-oriented policy making towards the CE	X	X				X	X	X					
	PR2: Public administration leads the change through circular public procurement	X					X	X	X					
	PR3: Innovate financing models to meet the CE needs	X		X			X	X	X	X				
	PR4: Harmonised CE regulation and standards	X					X	X	X			X		
	PR5: Empower consumers to adopt sustainable lifestyles	X			X	X	X	X	X			X		X
ST enabling a CE	PR6: Focus public support on emerging and advanced technology enablers	X	X	X			X	X	X		X	X		
	PR7: Reinforce the value creation approach in ST: Demonstrate capacity to shift to a CE	X	X	X			X				X	X		
	PR8: Promote and incentivise new ways of developing and delivering new technologies	X	X	X			X	X	X		X	X		
Educating for a circular future	PR9: Society awareness – Educate consumers to create sustainable lifestyles	X			X	X	X							X
	PR10: Industry awareness to drive changes in value creation and supply chains	X		X	X		X	X	X	X		X		
	PR11: Transformation of the education and training system	X	X		X	X	X	X	X			X	X	
Transitioning to a circular value creation system	PR12: Financial incentives for eco-design, sustainable production and circular business models	X		X			X			X				
	PR13: Legislative framework facilitating the transition to a circular value creation system	X		X			X							
	PR14: Support the articulation of regional/local closed loops...	X	X	X	X	X	X	X	X	X	X	X	X	

## 4.1 Policy setting right boundary conditions and a circular economy-stimulating framework

Direction-setting, through the establishment of right boundary conditions and a CE-stimulating framework, is the main task attributed to public authorities. Public authorities can adopt a mission-orientation approach and establish clear goals and a target date to achieve them, mobilise of significant public and/or private resources, make sure that CE cuts across different disciplines and sectors, and employ a mix of policy measures to meet the targets. They can innovate the financing models to meet the CE needs, pioneer the transformation and buy circular products and services at all levels of public spending, and establish a stimulating framework for consumers and producers to adapt their production and consumption patterns. All this needs to come along with effective information and education campaigns (see Chapter 4.3) and with other mechanisms to help consumers with making good decisions according to their preferences.

### Policy recommendation 1: Mission-oriented policy making towards the Circular Economy (CE)

Adopting mission-orientation means to state clear objectives (if possible quantifiable) as regards solving issues that matter to the citizens, and a target date to achieve the objectives. Other features that define mission-orientation refer to mobilising significant public and/or private resources, cut across different disciplines and sectors, and employ a mix of policy measures. Mission-orientation policy making as understood by FUTURING should also look at the potential to reinforce the European industry towards CE.

The Norwegian Electronic Vehicle initiative (started in 1989) is a good example of a mission. This initiative fulfils all criteria identified by the Mission Orientation Studies<sup>12</sup>. The Norwegian EV initiative is today a success. Norway has become a beacon of light across the world as the country having by far the highest share of EVs (by the end of the year 2017 the number of EV's surpassed 155,000). Norway has actually surpassed the original targets. The case provides many perspectives on this mission, that is characterised by solving issues that matter to the citizens (JIIP, 2018) – The full case study is available on <http://www.jiip.eu/dweb/news/norwegian-ev-initiative>

The following policy recommendations are issued in this regard:

- **Streamline CE in forthcoming policies:** CE should be embedded into Industry, R&I and education policies, next 'Regional Policy framework from 2020-2027', as well as into other forthcoming EU policies and legislative proposals. In this regard, the Circular Economy Progress for Stakeholders (CEPS) suggests that "like it has done with the smart specialisation strategies and climate

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<sup>12</sup> The Joint Institute for Innovation Policy with all its members (Joanneum Research, Tecnalia, TNO, VTT), Danish Technological Institute (DTI) and Valdani Vicari & Associati (VVA) are currently carrying out two mission-orientation studies for the Commission (DG RTD). One study looks at the definition, the conceptualisation and analyses cases around the world, to understand which lessons can be drawn from these. The second study analyses how such policies could be implemented in FP9.

earmarking, the EU can gradually introduce a coherency requirement in line with the CE" (Taranic et al, 2016). Besides, the cooperation among the two EC initiatives "Digitising European industry" and "An EU Action Plan for Circular Economy" should be reinforced, in order to achieve a digitally powered and CE featured industry. This goes hand-in-hand with public sector's commitment to build European industry's competitiveness on CE and other innovative capacities, as well as seeking a balance among economic, environmental and societal expected impacts.

#### **Pond of Berre Ecosystem**

Balancing the economic, environmental and societal impact to define a long-term strategy and vision of development allowed the ecosystem to recover from a much-degraded state to a natural ecosystem of high interest, while economy and society were also benefitting from the achieved progress. A process now embodied by the efforts of local authorities to propose the place to UNESCO's World Heritage list.

- **State clear objectives and set-up monitoring mechanisms:** This is about establishing clear ambitious goals, reaching global agreements around CE binding goals as it happens in the fight against climate change, and the set-up of infrastructures to monitor readiness and progress towards CE around harmonised indicators. The latter requires solving issues related to data availability and collection. This points to the same direction as the steps aimed at bridging the circularity gap suggested by Circle Economy while preparing this document (Circle Economy, 2018).

The European Commission (2018) has published a communication on the **monitoring framework for the circular economy**. The EC has suggested a set of indicators under the following categories: Production and consumption; Waste management; Secondary raw materials; and Competitiveness and innovation. The Commission will be improving the knowledge base and data availability for measuring progress in the CE, particularly as regards the data collection as well as the harmonisation of the methodologies for calculating the recycling rates. The first data and estimates are available on: <http://ec.europa.eu/eurostat/web/circular-economy/indicators/monitoring-framework>

Circle Economy has developed the **Global Circularity Metric** which says that only nine percent of the world economy is 'circular.

[https://docs.wixstatic.com/ugd/ad6e59\\_733a71635ad946bc9902dbdc52217018.pdf](https://docs.wixstatic.com/ugd/ad6e59_733a71635ad946bc9902dbdc52217018.pdf)

The FUTURING project has produced the **"EU Industrialization Scoreboard in a Circular Economy (EISCE)"**, which delivers a first step demonstration of feasibility for a meaningful monitoring of the "circular economy readiness" of European territories. See deliverable D3.3: Regional/National/International Scoreboard (publicly available on <http://www.futuring-project.eu/the-project>).

- **Innovative forms of cooperation and CE platforms:** The paradigm shift calls for rethinking local, national and global policy-making. The set-up of local stakeholder CE platforms, involving representatives from policy, industry, research, finance, education and society are crucial to endeavour the systemic change that the CE strives to (G-STIC Conference, 2017). Such platforms

must aim to align goals, pay-offs, complementarities in resources and support amongst stakeholders; and outline clear time horizons for a set of actions. Besides, global and innovative forms of cooperation across national borders and among a variety of actors are deemed decisive to meet the aforementioned global agreements.

**Circular Flanders** is a public-private partnership aiming to achieve a CE in Flanders. <http://vlaamsmaterialenprogramma.be/fmp>

**Circular Basque** is a network of organisations that are committed to promoting and implementing a CE in the Basque Country. <http://www.circularbasque.eus/>

## Policy Recommendation 2: Public administration leads the change through circular public procurement

Public Procurement represents a large share of GDP and hence green public procurement can be a driver for the CE and for innovation (European Commission, 2018).

- **Stricter CE requirements in public procurement:** CE has to be promoted by applying demand-side innovation policies. In the case of regions/cities, public procurement can play a key role in adopting CE principles (FUTURING, The Hague workshop), as it is happening with e-mobility in cities like Hamburg and Berlin in Germany or San Sebastian in Spain.

Incorporating CE criteria in the public procurement and grants, is one of the measures planned by the **Spanish Circular Economy Strategy**<sup>13</sup>. This measure is addressed to five Ministries, as well as regional authorities and the Federation of Municipalities and Provinces (FEMP). [http://www.mapama.gob.es/es/calidad-y-evaluacion-ambiental/participacion-publica/180206economyacircular\\_tcm7-479370.pdf](http://www.mapama.gob.es/es/calidad-y-evaluacion-ambiental/participacion-publica/180206economyacircular_tcm7-479370.pdf)

- **Enabling the scale-up of CE innovations co-funded by the EC:** Eco-innovative products and services recognized and co-financed by EU programmes, should have the leading edge in tenders run by other EU programmes such as European Structural and Investment Funds (ESIF) used for developing infrastructure and facilities for a modern EU (FUTURING, D2.2)

## Policy Recommendation 3: Innovate financing models to meet the CE needs

- **“Entrepreneurial State”<sup>14</sup> through “we win” models:** Almost every technology that makes the iPhone so ‘smart’ (the Internet, GPS, its touch-screen display and the voice-activated Siri), was – at least at its beginning – government funded. In the same way, disruptive innovation towards the CE could be also supported by public funding. This requires financing not only basic research, but also applied research and early stage financing of companies. In doing so, the State sometimes wins and sometimes fails, but in general terms “we win” models should be explored. Basically, this means

<sup>13</sup> Draft under discussion in February 2018

<sup>14</sup> The “Entrepreneurial State” vision has been promoted by Professor Maria Mazzucato

socialising not only the risks, but also the rewards (which normally are kept private). This way, the reimbursement made to the state by companies who made a profit out of public funds could be used to support further companies. This calls for deeper changes also in the tax system and State Aid rules. Besides, new ways to evaluate risks and returns are needed, especially to make product service systems apparent risk lower and get them more easily financeable (RECREATE, 2017).

- **Financing accessibility** is one of the main barriers for companies to adopt sustainable practices, particularly for SMEs and start-ups. This has been extensively addressed in literature and largely cited in the consultations made by FUTURING. The RECREATE project (2017) considers that addressing the finance accessibility of businesses - particularly beyond the competitive stage - is crucial to scale-up the CE. Important Projects of Common Interest (IPCEI) or European Fund for Strategic Investments (EFSI) are some of the EU funds set-up to support this kind of investments. However, the available funds have proved not to be sufficient and the European Commission (2016a) already proposed to increase their budget. Additionally, any bureaucracy to receive funding needs to be decreased, and coherence between different instruments has to be reinforced.
- **Innovate financing models** to meet the CE needs are needed. This can be achieved through the incorporation of value-creation and systemic approaches into the grants, incentives and other forms of support, instead of split incentives. With split incentives, “design for reuse” becomes for beneficial for the recovery company than for the manufacturer, and this is the kind of situation that the systemic approaches are aimed to avoid. In this regard, the inclusion of cascade funding or financial support to Third Parties in the Calls related to CE in the following ‘EU Framework Programme for Research and Innovation’ is recommended, along with seeking larger diversity in financing instruments in response to increased variety of business models (FUTURING, The Hague Workshop).

**Cascade funding** has proved to be very efficient in ensuring the SMEs participation in 2020 Horizon. From 2014 till 2020, around 5.500 SMEs are expected to be supported by Cascade Funding with more than 420 Million Euros distributed among them (estimations based on Work Programmes 2014-2020) (FUTURING, The Hague workshop, 2017)

## Policy Recommendation 4: Harmonised CE regulation and standards

Regulatory constraints are also preventing products for CE to be commercialised and reach the market. In fact, the stakeholders consulted in FUTURING call for “proper regulation in order to avoid the actual excess of regulation”. The EU should lead the CE regulation and standards deployment globally, and this should be done in coordination with the ongoing work regarding regulation and standards for a digitised industry.

- **Innovation Deals for CE:** The initiative of the Innovation Deals<sup>15</sup> launched by the European Commission is aimed at helping innovators with promising solutions to environmental issues address the regulatory challenges they face to bring their ideas to market. It is a positive practice

<sup>15</sup> <https://ec.europa.eu/research/innovation-deals/index.cfm>

that deserves to be intensified and widespread to more topics related to CE. More frequent calls for expressions of Innovation Deals for CE innovations and more references within the next work programmes could help to foster the initiatives and better associate this with proposals submission.

- **Harmonisation of European regulations and policies, and standards:** Meaningful efforts have already been made to improve the management of raw material and waste flows in Europe. But still, a better harmonization of European legislation and policies have been identified as a key lever towards a CE (FUTURING, D2.3). At the same time, the focus on the entire life-cycle of products should be reinforced. Besides, the tolerance for national level interpretations should be limited (FUTURING, D2.5), and tools to assess environmental impact of those policies and regulations have to be developed (FUTURING survey).

**Electric and electronic industry (WEEE<sup>16</sup> and RoHS<sup>17</sup>):** Although the directives are essentially "close" to one another and address the same industries / products, the interpretations of different terms (and its implementation) are profoundly different. For example, the EEE term is not uniformly interpreted / applied, which leads to certain products falling under the regulations at different times. A recommendation for EU policies would be to increase uniformity / consolidation of the laws.

**Automotive industry (ELV)** – the industry demands high recycling rates for end-of-life vehicles due to existing regulations. On the other hand, the industry is facing challenges and limitations due to the use of e.g. composites in lightweight construction reduction leading to negative environmental impacts over the life cycle

In the CE regulation and policies field, the following are some of the aspects that should be addressed in the short-run:

Eco-design	This directive should be sharpened and widened to really deliver design that triggers material circularity (FUTURING workshops, New Innonet project, 2017)
EU ecolabel	Improve consistency between the voluntary EU ecolabel and national/regional labels and enhance CE features (e.g. circular product design, remanufacturability and recyclability of products) in the ecolabel criteria. Beyond voluntary schemes, make them be systematically implemented.
Extended Producer Responsibility	Adequate and harmonised pricing of resource use and waste production (include negative environmental or social

<sup>16</sup> <http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32012L0019&from=EN>

<sup>17</sup> <http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32011L0065&from=EN>

	impacts in pricing, internalise the environmental costs), through cap-and-trade systems or via taxes.
Longer lifetime for products	Adopt the Parliament's recommendations (European Parliament, 2016a) and demand a minimum guaranteed lifetime in an harmonised way.

The EU-wide ban on incandescent light bulbs that started almost ten years ago exemplifies the power of EU regulation to change production and consumption patterns towards mitigating greenhouse gas emissions - while at the same time, fight against planned obsolescence (European Parliament, 2016b). From 1 September 2012, an EU directive aimed at reducing the energy use of lighting meant that retailers would no longer be allowed to sell 40W and 25W incandescent bulbs. Similar bans came into effect for 60W and 100W incandescent bulbs over the previous three years. The restrictions were predicted to save 39 terawatt-hours of electricity across the EU annually by 2020 (Hickman, 2012).

Besides, regulations around industrial symbiosis, as well as by-products, second-cycle products and used spare part are deemed necessary in order to facilitate the trading of secondary raw materials and remanufactured products (FUTURING workshops). and make a business case out of it. Likewise, **Total Cost of Ownership (TCO)** and **reinforcement of data and process security** are some of the fields to be tackled by EU regulation and standardisation. CE is about setting up closed loops and complex value networks, and this requires the exchange of highly sensitive data. This might include a common international legislation for international cloud services. The FUTURING consortium encourages the EC to facilitate the set-up of a EU Circular Standards platform, and to foster its convergence with current digital platform standards. Besides, consumer protection measures in favour of CE might have to be addressed in the near future (FUTURING survey).

## Policy Recommendation 5: Empower consumers to adopt sustainable lifestyles

- **Systematic information on the environmental impact and circularity of products:** Beyond voluntary schemes like the EU ecolabel, manufacturers should systematically inform users on the environmental impact and circularity of products. This way, consumers can easily identify the most sustainable products and services, and make evidence-based decisions. This can be achieved through appropriate legislation and/or awareness raising campaigns. Likewise, the market itself can push the industry to do so, as consumers can decide not to buy those products that do not include such information, or those that negatively impact the environment.

**The Clean Label** in the Food Sector is now more than a trend and it is becoming widely required not only by EU wide authorities, but also the consumers. The industry is answering to those requests and Clean Labels are increasing. This happened despite the lack of a broadly accepted definition of the concept, or a clear regulatory setting. The consumer behaviour, along with the industry response are shaping the concept.



- **Market incentives** in order to ensure that it pays off to be sustainable are essential towards changing the consumers' behaviour. Time-limited reduction of value-added tax (VAT) for repairing or for purchasing products certified as being manufactured under CE compliant practices, as well as subsidies, cheap loans or tax-reliefs to invest in costly items are some of the measures that can change the consumers' behaviour in the shorter run, until education and awareness raising strive a real shift in a longer run (FUTURING workshops, G-STIC 2017, FUTURING D2.1.) (see chapter 4.3. for more information). Besides, this needs to come along with incentives to those companies that are adapting the sustainable production patterns, adopting eco-design, experimenting with circular business models, as well as more and higher penalties for those that are not respecting the rules. (see chapter 4.4. for more information). In short, incentives that encourage maintenance and reuse, instead of replacement and discard can help overcome the current price disadvantage of products that are manufactured under CE practices.

The **Swedish government** is tackling the 'throwaway culture' by cutting VAT on fixing everything from bicycles to washing machines, so it will no longer make sense to throw out old or broken items and buy new ones. On bikes and clothes, specifically, VAT has been reduced from 25% to 12%, and on white goods consumers can claim back income tax due on the person doing the work. Besides, hopes are, that the tax break on appliances will spur the creation of a new home-repairs service industry, providing much-needed jobs for new immigrants who lack formal education. The incentives are part of a shift in government focus from reducing carbon emissions produced domestically to reducing emissions tied to goods produced elsewhere.

## 4.2 Science and technology enabling a circular economy

### Policy Recommendation 6: Focus public support on emerging and advanced technology enablers, with high potential to re-industrialise Europe within the CE

Technologies enabling a CE can be grouped into environmental technologies and recycling, digitisation or industry 4.0., and new materials (biodegradable, biomaterial, etc.). See Table 3 to better understand the most promising advanced technological enablers. Besides, there are other relevant R&D areas to re-industrialise Europe within the CE, including human-machine interaction, consumer behaviour, indicators for the assessment of CE, or CE rebound effect - CE rebound occurs when CE activities, which have lower per-unit-production impacts, also cause increased levels of production, reducing their benefit (Zink et al, 2017). Public support to emerging and advanced technology enablers can de-risk those innovations and attract private funding. The proposed technologies are in line with the research trends and priority areas that the European RDI is investing upon so as to meet the demands in society and environment of the future. Most important is that the technology groups are foreseen as boosters for accelerating the transition to a circular economy model on one hand and secondly promise its sustainability.

### Policy Recommendation 7: Reinforce the value creation approach in Science and Technology - Demonstrate the capacity of technological advancements to shift to a CE

- **Adopt value creation and systemic approaches in R&D funding:** Instead of supporting single-application technologies, next R&D&I programmes should keep on fostering the integration and maturity of technological solutions that work across disciplines and sectors, and support the



product-service combinations as well as other circular business models. To do so, it is crucial to put the SME value chains under the spotlight for the future of European research on manufacturing, and to unlock the potential of Cascade Funding or support to Third Parties (FUTURING, The Hague workshop).

- **Conditional R&DI public funding:** In order to guarantee that the funded R&D outcomes are promoting the shift to a CE, R&D&I funding applicants can be asked to describe how the new technologies and innovations in the applications promote the CE implementation, and to use this information as an additional evaluation criterion. For instance, applicants can elaborate on how the technological solutions proposed empower people to change consumption behaviour and make their lifestyles more sustainable (G-STIC, 2017)
- **Eco-innovation, and environmental (through LCA and others) and societal impact assessment systematically** performed within research and innovation projects:

Eco-innovation should be embedded in future in EU calls, not only by integrating LCA in projects, but also by encouraging proposal submitters to lead eco-innovation from the very beginning of the concept design. This would help to (i) secure an environmental impact in the exploitation of the project and (ii) to disseminate such practices to progressively change mindsets across research and education players, industries and societal stakeholders. Besides supporting research and knowledge creation in LCA, and beyond the regulation compliance, this is a way to recognise the pivotal role of LCA in closing loops. (FUTURING, D2.2.).

As it happens with the economic impact, applicants can be asked to assess the societal impact. In fact, some H2020 calls already ask for consideration of “societal readiness levels” (SRLs) as an alternative/complementary to typical TRLs. But beyond isolated calls, the societal impact should be mainstreamed in all the EU-funded R&D&I projects, by obliging the applicants to address it in the exploitation plan (FUTURING, The Hague workshop; D2.2). The assessment of the societal impact can deal with for example, targeting the level and type of jobs that will be created. FUTURING D2.2. establishes four different categories depending on the project, the field of application, and the level of disruptiveness:

- Innovations requiring new jobs with upgraded skills at high-qualification levels
- Innovations requiring new low-qualified jobs but necessarily to be preserved at a local scale;
- Innovations having positive externalities on jobs quality by improving safety, ergonomics etc.
- Innovations having negative externalities on future jobs because of new operational risks

## **Policy Recommendation 8: Promote and incentivise new ways of developing and delivering new technologies**

New ways of developing and delivering technologies to safeguard that they add real value towards the transformation into a CE that also brings social benefits, can entail the following:

- Reinforce demonstration activities to show effectiveness in real-life conditions and deploying them more effectively at scale.
- Support stakeholders in shaping mission-oriented applications of integrated technological solutions, through multi-stakeholder platforms (living labs) for project partners to implement and test (G-STIC, 2017)
- Establishment of a Digital Innovation Hub on CE (similarly to the Circular Economy Platform of the Americas. <http://www.cep-americas.com/>) (FUTURING Survey)
- Active participation of youth in technology development and dissemination, and ensure a gender-responsive approach to the technological innovation cycle (technological innovations that advance gender equality)
- Incentives for user-driven innovation and open innovation
- Strongly support SMEs in research and development of solutions that will promote the CE.

### 4.3 Educating for a circular future

Education has been widely regarded by the stakeholders consulted in FUTURING as being crucial -and perhaps the most crucial aspect- to strive a CE. It offers tremendous potential to change business and consumer behaviour, and hence, transform the consumption and production patterns (across industries and actors/stakeholders). However, the benefits are unleashed in the longer run. Therefore, education measures need to be accompanied by market and fiscal incentives both for the consumers (addressed in Policy Recommendation 5) and the industry (addressed in Policy Recommendation 12) in order to make sure that it pays-off to be sustainable, as well as sound regulation measures (Policy Recommendations 4 and 13).

#### **Policy Recommendation 9: Society awareness - Educate consumers to create sustainable lifestyles**

Public authorities are determinant to raise societal awareness and to educate the consumers in CE parameters. The success of high-durability products ultimately depends on consumer behavior in the marketplace. This way, consumers can push the industry to change their business behavior. But this means, amongst other, to fight the frequent product replacements, which often takes place in response to fashion and new technology rather than as a result of declining performance or irreparable technical failure (Echegaray, 2015; FUTURING survey). This phenomenon is known as psychological, subjective or symbolic obsolescence. Amongst others, they can launch, support and facilitate:

- **CE information and awareness programmes:** The stakeholders consulted in FUTURING are concerned about the lack of awareness and information on the CE principles and potential, and deem that this is fundamental to change current lifestyles. Public authorities could address this by launching and facilitating the set-up of programmes aiming at informing the society on the benefits and value of transitioning to a CE, embedding CE awareness in primary and secondary school curricula, creating awareness of the intergenerational CE debt (cumulative environmental issues shifted to the future generations), reinforce trust in re-used, remanufactured, refurbished and recycled materials (and products). Successful examples elsewhere are powerful to communicate the benefits of the CE. Besides, the society has to be duly informed about e.g. the market incentives that are available.

- **Make scientifically-validated information widely available:** Many technological solutions that can help spin the CE are readily available. There are other factors that are hindering these solutions to be commercialised (FUTURING interviews and workshops, G-STIC 2017). The role of technical and scientific culture in society is one aspect to be further explored and reinforced.

## Policy Recommendation 10: Industry awareness to drive changes in value creation and supply chains

The transition to a CE brings new challenges for European companies, hand in hand with great opportunities. Public authorities have a significant role to play in making the industry aware of these opportunities, and facilitating the changes in value creation and supply chains (e.g. enabling access to finance, training, test and demonstrating R&D infrastructure, etc.). The real change in the mind-set of companies and their production patterns will not unfold as a result of legal enforcement, or just by their willingness to minimise their negative environmental and add value to the society (and hence, earning the trust of employees, consumers, investors and other stakeholders), but mainly due to the economic gains that they can achieve by changing their value creation and supply chains. Amongst others, public authorities can launch, support and facilitate:

- **CE information and awareness programmes for the industry:** Industry, particularly SMEs are lacking information about the opportunities that the CE represents for their business, and they are not duly aware of how their business might be impacted by the changes in the regulatory settings that may come into force in the near future, or by changes in consumers' behaviour. Their knowledge about the incentives and grants that the public authorities are offering for them to change the production patterns and incorporate CE enabling technologies and circular business models is often insufficient (often due to the fragmented information), and they are lacking the appropriate skills to undergo such a significant change (see next policy recommendation for more information). All these aspects should be duly addressed by information and awareness programmes. In particular, trust in re-used, recycled materials (and products), on availability and quality of resources in closed loops need to be reinforced by these information and awareness measures.
- **Showcase CE best practices and success stories:** Showcasing examples of how CE works in real life and how a business case can be made out of it, is of significant importance to persuade companies to adopt eco-design, explore the potential for remanufacturing and reverse logistics, or develop circular business models. Particularly, if they feel close to that company (in terms of sector, size, markets, etc.). Hence, in addition to EU wide case study catalogues, local public authorities should foster the set-up of databases to communicate successful local examples, facilitate the creation of platforms where companies can share their experience, and award those that are stepping towards changing a circular future (Circular Economy prizes). In recent years, many business cases have been highlighted as being good CE examples by multiple initiatives, public authorities, organisations and projects. A selection is included below:

**Circulator – The circular business model mixer:** A project funded by EIT Raw Materials aimed at supporting aspiring entrepreneurs in making conscious strategic choices regarding the

sustainability of their business model and value proposition. It includes a case browser: <http://www.circulator.eu/browse-the-cases>

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

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

## Policy Recommendation 11: Transformation of education and training systems

In addition to communicating the CE benefits, opportunities and making the information about the existing incentives more accessible, the education and training systems are to be transformed, using novel knowledge delivery mechanisms (e.g. Teaching Factory paradigm), to incorporate the CE principles:

- **Eco-innovation and CE principles need to be embedded** into all or nearly all education curricula and from elementary school to university and lifelong learning.

**Scotland** is building on existing work to encourage schools to embed CE principles within their curriculum. Zero Waste Scotland is working with Education Scotland to identify and support a cohort of **teaching 'champions'** for the CE. This grouping will provide opportunities for practitioners from different sectors and subject specialisms to work collaboratively to develop a range of learning resources for use in the classroom and online.

- **Develop International qualification systems** for new job profiles needed in industry to transition to circular production patterns (e.g. CE manager). The ERASMUS+ initiatives can promote the changes to qualifications and national curricula to meet emerging professional needs for 'green skills', particularly in the sectors of the Blueprint for the Sectoral Cooperation on Skills (as in the 2017 call of Sector Skills Alliances).
- Support companies to **upskill their workforce** so that they are able to capitalise the opportunities that CE represents. This can be done through launching a fund to train staff in a particular CE aspect (for example, Scotland launched a fund for third sector groups to apply for funding to train staff in repair skills), in combination with longer term concerted actions to upskill the workforce to better respond to an emerging CE.

Under the "Making Things Last - A Circular Economy Strategy for Scotland", Zero Waste Scotland and Skills Development Scotland are exploring the scope for a **skills academy for the CE**, in conjunction with Sector Skills Councils, employers, Industry Leadership Groups, and skills partnerships. This would co-ordinate work to develop the skills required for a more CE across sectors. Identified needs range from semi-skilled activities in resource management; skilled roles

in remanufacturing; and highly skilled design and business studies related activities - helping build a flexible and adaptable workforce to respond to an emerging CE.

#### 4.4 Transitioning to a circular value creation system

Industry stakeholders and entrepreneurs play the decisive role in transforming the European industry towards a circular value creation system. It is the economic aspect of making profit that is the entrepreneurial incentive and the key driving force for the transition towards a CE. Thus, circular value creation systems and business models should not be in contrast to, but favour businesses' competitiveness. In that context, public authorities could facilitate the transformation of the European Industry towards a circular value creation system e.g. with joint actions in public-private partnerships, incentives to go circular, or regulation.

#### **Policy Recommendation 12: Financial incentives for eco-design, sustainable production and CE business models**

Although promotion of eco-design is one of the Extended Producer Responsibility (EPR) objectives, most of the current EPR systems do not incentivise design for recyclability, reusability or longer lasting products (New Innonet project, 2017)

- New incentive system for CE: Fee to retailers to collect used products, recyclability bonus, tax reliefs, changing financing evaluation of companies that follow the CE principles (e.g. financial advantage to those companies that meet the eco-design related targets) are some examples of how eco-design, sustainable production and CE business models can be incentivised. Likewise, higher levies on e.g. non-recyclable products/materials and remanufacturable products could be implemented.
- Such an incentives system, requires setting-up standard accounting practices of individual enterprises.

The *Ellen MacArthur Foundation* and *Granta Design* have developed a set of Material Circularity Indicators to be applied at the company level, providing tools to measure input into the production process. These and similar kinds of indicators could be incorporated into standard accounting practices of individual enterprises

- Grants or good condition loans to assist companies (especially SMEs) on capitalising the opportunities that CE represents: products and industrial processes optimizations based on LCA (up to now mainly used for informative purposes rather than for product optimization and decision-making) and other approaches, technology acquisition, upskilling, replication of successful examples, hiring new professionals, etc. Besides, subsidies can be used to make recycled materials cheaper (New Innonet project, 2017)

### Policy Recommendation 13: Legislative framework facilitating the transition to a circular value creation system

As pointed out in Chapter 4.3. “Educating for a circular future” needs to come along with adequate and harmonised (see Policy Recommendation 4) regulatory adjustments that pushes the industry to start abandoning the linear economy practices as soon as possible. Promotion and establishment of rules concerning Extended Producer Responsibility, setting a minimum guaranteed lifetime of products (per product typology), establishing requirements for product labelling and traceability, possible mandatory use of circulated materials in products, right pricing of raw materials (in order to make virgin materials more expensive), are some of the measures to be explored in this regard.

### Policy Recommendation 14: Support the articulation of regional/local closed loops, complex value networks and CE one-stop-shops

The **regionalisation of value streams** for consumer products (e.g. clothing, shoes, etc. manufactured in high-performance factories close to the customers) could tremendously reduce the global footprint (due to shortened transport) and at the same time increase the socio-economic impact for Europe (new jobs, higher business success, etc.). For the introduction of regional product life-cycles in the context and related to the electrification of machines (e.g. electric cars) heavy investments in the infrastructure and ecosystems are needed from public and private stakeholders in order to facilitate the regional recycling, remanufacturing/refurbishment and reuse of components (batteries, etc.). In addition to incorporating systemic approaches into the grants (and support the set-up of regional closed-loops, industrial symbiosis approaches and complex value networks, instead of single-company oriented projects/solutions) – as demanded in Policy Recommendation 3, the following can be rolled-out by public authorities in this regard:

- **Gather and analyse data on industrial material and waste flows, inputs and outputs at different geographical scales:** Gathering data related to industrial material and waste flows, as well as other indicators to feed the CE monitoring mechanisms suggested in other policy recommendations requests significant public-private efforts. Besides, the analysis of such material flows can drive strategic decision-making.
- **Financially support the set-up of platforms** that provide information on local material and waste flows, existing technologies (e.g. related to recycling and upcycling solutions), regulations and standards, incentives, etc.



**OVALEC digital tool:** The CSTB, BRGM, Bouygues Construction, and the HQE Association – France GBC are developing a new tool to reinforce the CE principles in the building sector (mineral material and waste flow), considering local specificities like waste treatment facilities over the territory. It looks at local/regional aggregate availability and location of C&D waste storage or recycling platforms. As a supplement to the current ACV Building tools, OVALEC will specifically integrate the characteristics of the local context, and propose possible scenarios for managing the materials at the end of the life cycle of the structures. OVALEC will thus help reduce the impact of non-renewable materials, while increasing the quantity of recycled or reused secondary resources, and limiting the amount of waste when the building is demolished.



Founded in 2007 by and for the PV industry, PV CYCLE (A non-for-profit member-based organization) today includes a broad range of electrical and electronic equipment, batteries, packaging and industrial waste in its portfolio. The organization has national representations and partnerships throughout the globe. PV CYCLE offers both collective and tailor-made waste management and legal compliance services for companies and waste holders around the world.

## 5 Roadmap to future EU industry

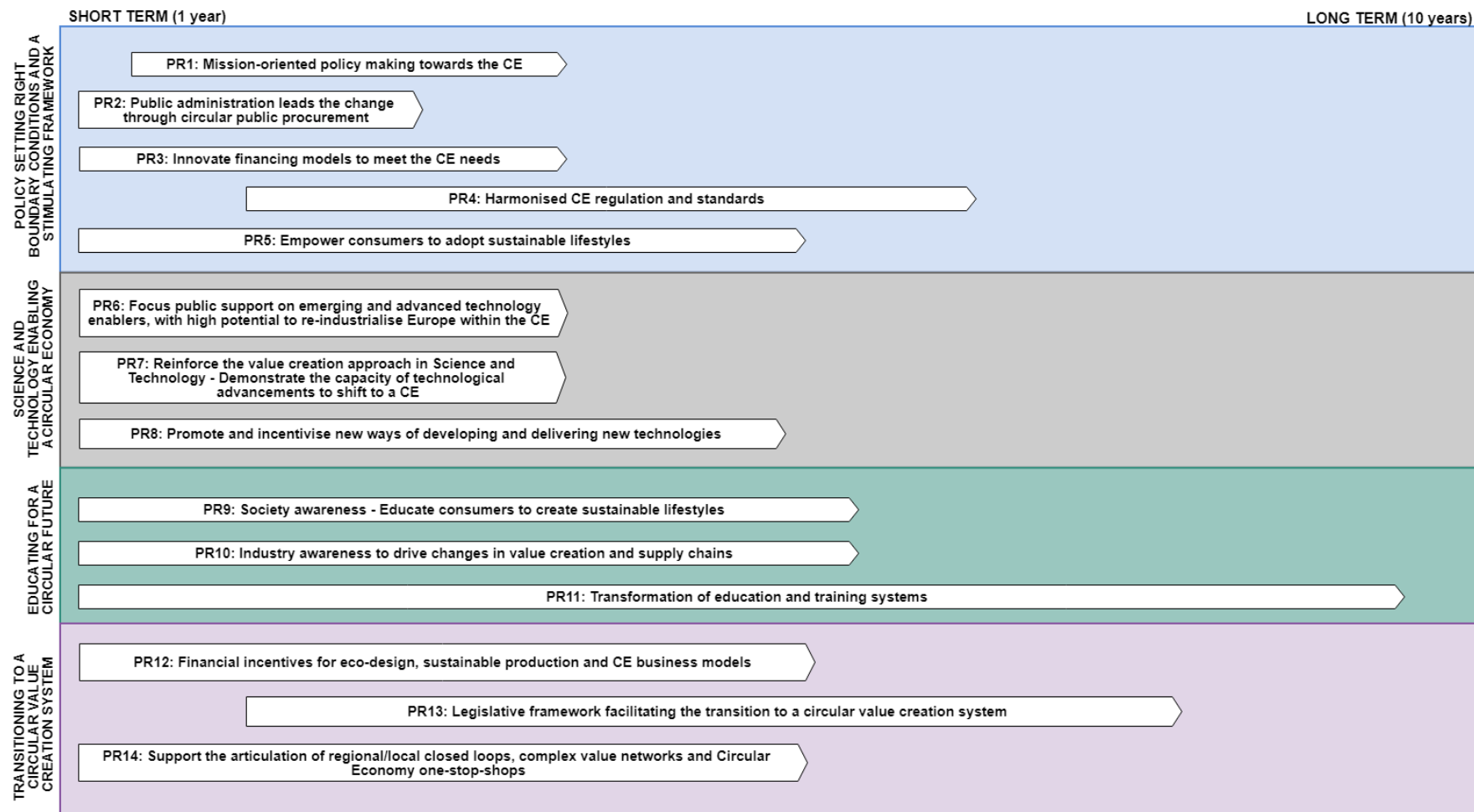
The FUTURING consortium strongly advises the policy makers, to conduct a thorough overall impact assessment before concrete up taking the above policy recommendations for specific sectors, cases, etc. in order to avoid unforeseen and unintended negative side effects (also known as *CE rebound effect*). For example, increasing the lifetime of products could have positive effects regarding materials and energy consumption but also drawbacks as regards innovation – due to much longer product and innovation– with negative effect on global competitiveness. In such a context, a “wise” policy making which follows a systemic approach – taking into account the whole policy spectrum for facilitating the innovation system – is needed. In the case of prolonging the lifetime of products, the promotion of modularising products or even virtualising functionalities (which enables the exchange or upgrade of single modules such as we have it e.g. in airplanes) could be one solution to combine longer product lifetime with high innovation rate.

Having said this, the following roadmap represents the policy recommendations under each of the four categories of measures proposed to reindustrialise Europe within the CE. It is formulated on the basis of the previously described experts’ and stakeholders’ views.

The arrows indicate when a certain action should be applied and when its real impact is expected to take hold, that is, the end of the arrows represents when the implemented policy measures will have the expected results. This does not entail that the measures should be stop being implemented in that moment in time, the initial results should be assessed and decision should be made about their continuation, modification or withdrawal.

Regarding the timeline, short-term represents a 1-5-year period, medium-term a 5-10-year period and long-term a more than 10 years period.







## 6 Conclusions

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A brighter European industry, according to FUTURING, can be defined as “A clean, smart and innovative industry for all Europeans”. The **Circular Economy (CE)** approach, powered by **digital transformation**, is at the core of an industry that is able to bring together economic, social and environmental gains. Such kind of industry is featured by “producing responsibly” (through circular value creation systems) to “respond to the needs of citizens that consume responsibly”.

The **4th industrial revolution provides the European industry with a set of business opportunities on the way to transitioning to a circular value creation system**. Taking the whole product life cycle into account, companies can provide new value adding services which e.g. help the customers or users to use the physical product as long as possible (e.g. using predictive maintenance) with the highest performance (e.g. with software updates or exchanging/upgrading parts) and the lowest environmental impact (e.g. resource efficiency services). A variety of new (service) businesses and jobs will arise e.g. in the field of designing new (modular, cyber-physical, etc.) products and value chains, in the field of recycling, reusing and remanufacturing, etc. Increased resource productivity will become a substantial part of competitive advantage as raw materials prices rise and the costs of establishing reverse cycles decline

Europe exhibits a sound position within the world community in order to change its industry with regard to circularity and the 4<sup>th</sup> industrial revolution, especially as far as technology development is concerned. But it needs to make sure that those technologies are brought into the market in a timely and successful manner. Besides, some other regions are investing heavily in enabling technologies and Europe could lose its role as a vanguard, and fail to fully reap the benefits from the CE, unless a **joint venture among public authorities at various levels, industry, R&D organisations, education institutions, financiers and societal actors at large is achieved** and global agreements are reached. The potential of mission-oriented policy to solve the complex, multi-faced challenges of reindustrialising Europe within the framework of the CE has to be explored in this regard. **Adopting a systemic approach to policy-making and taking into consideration the whole policy spectrum** (and thus limit the CE rebound effect) **in a stepwise approach** is equally important. Education and innovation are crucial to lay the ground for a cutting-edge, digitalised and circular economy principles-based EU industry that brings wealth, jobs and welfare across Europe. Therefore, FUTURING strongly encourages public authorities across Europe to take action in educating for a circular future and to revise the R&I and industrial policy to make sure that relevant R&D outcomes are adopted by the European businesses:

- Policy-making has to safeguard that the **R&I funding is enhancing the competitiveness of the European manufacturing industry in a more sustainable and responsible manner**. This points at the nature of the technological solutions (optimising the use of resources and materials through the life-cycle, development of new materials, increase the use of secondary raw materials, etc.), as well as at the maturity and integration needed for the European industry to reap the opportunities offered by those technologies. Conditional R&I public funding and systematic environmental, societal impact assessment, new ways of developing and delivering technologies and the use of EU-funded technologies in ESIF and other EU programmes (e.g. to

develop infrastructures and facilities for a modern EU), are some of the measures suggested for future R&I programmes.

- **Educating for a circular future** stand out as a major catalyst for CE adoption or shifting lifestyles and production patterns, while FUTURING work and consultations revealed a significant gap in this regard, and recommends **addressing it rapidly**. **Educating the industry** in CE parameters is first and foremost about making the industry aware of the business opportunities in the CE. This can provide the motivation to transition to circular value creation systems, and most likely in a more accelerated pace than through other measures such as legal enforcement or mere attention to diminishing the negative environmental impact of mainstream production patterns. Equally, **R&D players and other stakeholders** such as private financiers are to be educated to make sure that R&D outcomes add real value to the European industry (in economic, societal and environmental terms) in the first case, and to safeguard that CE innovations get financed. Similarly, the **society has to be duly informed** about the benefits and value of transitioning to a CE, early since primary and secondary education. This is all crucial to increase trust in re-used, remanufactured, refurbished and recycled materials and products and hence, trigger changes in both the consumption and production spheres. These policy measures have to come along with new ways to evaluate risks and returns, - to lower the apparent risk of product service systems and get them more easily financeable, as well as with societal debates (e.g. regarding privacy aspects in the context of tracking and tracing value streams).

Hence, **all stakeholders will get prepared** for upcoming regulations and directives that rule the incentives system, funding programmes (R&I, but also funding for the articulation of regional/local closed loops, complex value networks and CE one-stop-shops, upskilling; etc.) and other support schemes, and also bring new obligations and rights.

Last but not least, the establishment of monitoring mechanisms at various levels are fundamental to guarantee the transition towards a CE:

- a) **Public authorities at various levels (EU, MS, region, cities, etc.):** authorities have to state clear objectives and set-up monitoring mechanisms, so that all stakeholders can rely on a shared and kept up-to-date situation assessment. The EC has recently released a communication about the "Monitoring framework for the circular economy", which makes available first data sets so as to develop a monitoring of progress achieved by the European Union and its Member States towards a circular economy. Taking stock of its analysis in terms of building blocks and pillar actions, FUTURING has suggested through its "EU Industrialization Scoreboard in a Circular Economy (EISCE)" an approach to enable the fine monitoring of smaller territorial units - regions and cities - as concerns their framework readiness for supporting local stakeholders' initiatives and host progress towards circularization. Both approaches - broad progress achievement assessment and fine readiness for progress assessment - are indeed complementary policy tools that both need to be deployed.
- b) **Companies:** Companies have also to establish clear goals and measure progress to achieve them, in order to evaluate the adequateness of the measures and investments made in this

regard, including with taking into account different time scales, taking stock on the lifecycle assessments, and considering multiple criteria of impact.

- c) **Public policies and regulations:** Regular impact assessment of public policies and regulations (ex-ante, ongoing and ex-post) is deemed indispensable, in order to assess their environmental, economic and social impact, and adjust the measures accordingly. Outcomes the assessments have to be widely accessible.

## 7 Bibliography

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Carayannis E., Campbell D., Barth, T.D. (2012) 'The Quintuple Helix Innovation Model: Global Warming as a Challenge and Driver for Innovation', *Journal of Innovation and Entrepreneurship*, 2012 1:2. (doi:10.1186/2192-5372-1-2)

Carayannis, E. G., & Campbell, D. (2010). Triple helix, quadruple helix and quintuple helix and how do knowledge, innovation and the environment relate to each other? A proposed framework for a transdisciplinary analysis of sustainable development and social ecology. *International Journal of Social Ecology and Sustainable Development*, 1(1), 41–69.

Circle Economy (2018), "The CIRCULARITY report"

Circle Economy and EHERO (2016), "Circular jobs: Understanding Employment in the Circular Economy in the Netherlands"

Echegaray, F. (2015), "Consumers' reactions to product obsolescence in emerging markets: the case of Brazil", *Journal of Cleaner Production*, <http://dx.doi.org/10.1016/j.jclepro.2015.08.119>

ECOFYS (n.d.), "Get a head-start: Economic opportunity through circularity"

European Commission (2018), "Communication on a monitoring framework for the circular economy", COM (2018) 29 final, SWD(2018) 17 final

European Commission (2017), "White Paper on the future of Europe: Reflections and scenarios for the EU27 by 2025"

European Commission (2017a), "LAB – FAB – APP: Investing in the European future we want. Report of the independent High-Level Group on maximising the impact of EU Research & Innovation Programmes"

European Commission (2016), "Next steps for a sustainable European future European action for sustainability", COM(2016) 739 final, SWD(2016) 390 final}

European Commission (2016a), "Europe's next leaders: the Start-up and Scale-up Initiative", COM(2016) 733 final

European Parliament (2016), "Closing the loop - New circular economy package", Briefing January 2016

European Parliament (2016a), "A longer lifetime for products: Benefits for consumers and companies"

European Parliament (2016b), "Planned obsolescence: Exploring the issue", Briefing May 2016

European Commission (2014), "17<sup>th</sup> European Forum on Eco-innovation: Transforming jobs and skills for a resource efficient, inclusive and circular economy. Recommendations and summary of the event", Lyon, December 1-2, 2014.

European Parliament (2009), "Directive 2009/125/EC of the European Parliament and of the Council of 21 October 2009 establishing a framework for the setting of ecodesign requirements for energy-related products (recast)

FUTURING D1.1. FUTURING Operational Framework, 2016

FUTURING D1.2. FUTURING Baseline vision, 2016

FUTURING D1.3. Description of the Building Blocks and Pillar Actions methodology, 2017

FUTURING D2.2. EU projects assessment report, 2017

FUTURING D2.3: Business and civil society consultation survey, 2017

D2.4: List of Advanced Industry Enablers in the circular economy, 2017

FUTURING D2.5. Map of European R&D&I Competitive Position compared to Advanced and Emerging Markets, 2017

FUTURING D3.2. Inventory of cases/strategies for potential future large-scale industrial investments in Europe, 2017

FUTURING D3.3. Regional/National/International Scoreboard, 2018

FUTURING workshop Lyon, 1<sup>st</sup> of December 2016

FUTURING workshop The Hague, 10<sup>th</sup> of October, 2017

FUTURING workshop Athens, 12<sup>th</sup> of December, 2017

Government of The Netherlands (2016), "A circular economy in The Netherlands by 2050"

G-STIC Conference (2017), "Moving towards a digitally powered circular economy. Conclusions of the GSTIC Circular Economy Track"

Hickman, L. (2012), "Light goes out for incandescent bulbs", article published in The Guardian, 31<sup>st</sup> of August, 2012

Mazzucato, M. (2018), "Mission-Oriented Research & Innovation in the European Union: A problem-solving approach to fuel innovation-led growth"

NEW-INNONET PROJECT (2017), "Policy recommendations to unleash the power of circulating materials"

OECD (2016), "Policy Guidance on Resource Efficiency"

RECREATE project (2017), "Scaling-up the circular economy: Recommendations for finance, regulation and required innovations"

Sautter, B. (2016), "Futuring European industry: assessing the ManuFuture road towards EU re-industrialization". European Journal of Futures Research 4:25, available at <https://link.springer.com/article/10.1007/s40309-016-0100-6>

Scottish Government (2016), "Making Things Last - A Circular Economy Strategy for Scotland"

Social and Economic Council (2017), "Key points - The transition to a circular economy: Summary of the Social and Economic Council advisory report"

TARANIC, I; BEHRENS, A. and TOPI, C. (2016), "Understanding the Circular Economy in Europe, from Resource Efficiency to Sharing Platforms: The CEPS Framework". CEPS Special Report. No. 143 / July 2016

WEF – World Economic Forum; the Ellen MacArthur Foundation and McKinsey & Company (2014), "Towards the Circular Economy: Accelerating the scale-up across global supply chains"

ZINK, T., GEYER, R. (2017), "Circular Economy Rebound", Article in Journal of Industrial Ecology, February 2017