New Direction

CIRCULAR ECONOMY

AGENDA 2030 FOR SUSTAINABLE DEVELOPMENT: NEW TRENDS AND FUTURE PROSPECTS FOR ENVIRONMENTAL, SOCIAL AND ECONOMIC SECURITY OF THE EUROPEAN UNION

IOANNIS E. NIKOLAOU & ARGYRIS PATAKAKIS

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REGISTERED OFFICE: Rue du Trône, 4, 1000 Brussels, Belgium. **EXECUTIVE DIRECTOR:** Naweed Khan.

Ioannis E. Nikolaou

Ioannis E. Nikolaou is an associate Professor in the Department of Environmental Engineering at the Democritus University of Thrace. He holds a degree from the department of Economics of the Athens University for Business and Economics, a BA degree from the Department of Environment of the University of Aegean and a Ph.D. Degree in Corporate Sustainability from the University of the Aegean. His research interests include: corporate sustainability, sustainable accounting and reporting, circular economy, corporate social responsibility and Agenda 2030, green intellectual capital and knowledge based theory.

Argyris Patakakis

Argyris Patakakis is holds a degree from the department of Environmental and Natural Resources Engineering, of the Department Applied Sciences TEI of Crete, a MSc degree from the Department of Environmental Engineering and Science of the Democritus University of Thrace. His research interests include: corporate sustainability, circular economy, corporate social responsibility.

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INTRODUCTION

The severe effects of the financial crisis of 2009 were felt not only on the economy but also in the civil society, and as a result they have put the foundations of the EU into question. The debate over this crisis of confidence, which has so far been focused on ideology and the clash between left wing and right wing populism, while significant ideas (e.g. sustainability and circular economy) have gained great momentum among members of the EU as a solution for the economic crisis. The concept of sustainable development and the circular economy are considered important European policies which have been promoted by several international institutional documents and policy papers.

The European Commission was the first to suggest this shared vision for action for EU Member States in order to introduce policies and principles for Sustainable Development (Agenda 2030) as well as the principles of circular economy (Circular Economy Action Plan of European Commission). These principles focus on protecting untapped natural resources and decrease the dependence of European Member States on scarce natural resources (e.g. energy, and fossil fuels) and of course from overseas (foreign dependence). Additionally, they aim at promoting economic development through the circular economy and circular (green) entrepreneurship challenges as well as at offering a safe and economically prosperous life for European citizens.

This report describes the current state of European Member States regarding the introduction of the Agenda 2030, the circular economy and their future prospects. Particularly, a review of current policy documents of European institutions regarding the circular economy, and the Agenda 2030 as well. It explores how these concepts could be associated with each other to promote a sustainable European society. Current policy tools will be presented in order to assist scholars and decision makers in setting out a roadmap of current to be able to promote economic, environmental and social goals of sustainable development. This analysis is classified in three general categories such as at micro, meso and macro-level.

On the micro-level, a demand and supply approach will be adopted to examine circular economy models and the Agenda 2030 as well as sustainable consumption issues. The meso-level will focus mainly on industrial ecology issues and Agenda 2030 and macro-level includes policy instruments (e.g. command-and-control and market-based instruments) at country level.

Finally, we are obliged to ask questions such as how the current policy tools could play a critical role in economic development, innovation and competitiveness of European countries? If the new legislative requirements are useful for the business community or if some new incentives could be needed for European economies and societies? What trade-offs between conventional and circular economy types of entrepreneurship are necessary for the safety of the European and Greek economy? What are the best points of substitution of conventional and circular economy entrepreneurship? What should Europe and Greece do to promote the circular economy?

1.1 The EU policy for sustainable development

Sustainable development is a concept which has lately gained momentum among Member States of European Union (EU). Essentially, it is a normative (political) definition which has been put forward by the Brundtland' Commissions reports in 1987 as the economic development which takes care the needs of current generations without jeopardizing the desires of future generations (Brundtland *et al.*, 1987). The current definition is applied more in the context of preservation of natural resources for the next generation. Critiques are either based on the needs of the future generations or the technological breakthroughs of the future.

Brundtland's definition has faced much doubt. It is considered to be ethical-orientated, based on assertions for preserving the environment without clear scientific findings (Sneddon *et al.*, 2006). Another vein of criticisms has focused on the needs of future generations and the inability for societies to define them clearly. The question is therefore who – who decides what the needs of future generations are? From a moral point of view, this sounds cold and dethatched since it is close to saying that parents are not interested in their children's future. However, we cannot ignore the historical progress of society, and particularly the change in basic needs from generation to generation. Obviously, this implies failures in cases where decision makers based their views on the needs of future generations on general assumptions. If we could imagine a similar debate decades ago regarding the needs of the current society, how likely is the suggestions of this debate to have met our needs of today.

The evolution of technology is another vein of criticism for the concept of sustainable development. Who is able to know today what future capabilities of technology regarding the fuel and food will be? Who has the ability to predict the path of technological progress of production? As it is foolish today to imagine new ways of transporting goods in the future (due to the technological evolution and of course less needs for fuels), just as decades ago it was difficult to imagine the invention of mobile phones, computers and social media. This argument for the inability of models to capture technological developments for the sake of protection of natural resource and promoting the goals of sustainable development was introduced very earlier on in the work of Donella Meadows - *"The Limits to Growth"* (Passell *et al.*, 1927; Cole *et al.*, 1973).

After the conference on the *"Environment and Development"* which was held in RIO in 1992, the concept of sustainable development made a clear distinction of three general pillars: a) the economy, b) the environment and c) the people. The action plan that came from this conference, specified some values, strategies and practices which every civil society and economic actor could adopt in order to accomplish the goals of sustainable development. Some directions have been suggested for education, businesses and consumers mainly to achieve economic growth, environmental protection and social equity. 2015 was an important milestone for sustainable development since the UN broadened the three classical dimensions with an additional 17 goals for Sustainable Development Goals (SDGs) including basic human needs (e.g. poverty, hunger, health, education), economic development goals (e.g. industry, infrastructure, decent jobs, sustainable production and consumption) as well as environmental goals (e.g. climate change, under and above water etc.).

These milestones of sustainable development are also followed from EU to promote a better life for its citizens. Indeed, many European institution documents have been launched to promote sustainable development. "A Sustainable Europe for a Better World: A European Union Strategy for Sustainable Development" (Jenkins, 2002) is an important institutional document which aimed to response to the request of Helsinki's summit in 1999 to provide an alternative European strategy with respect to economic development, to natural environmental protection and societal cohesion. This document strives to align European policies with Brundtland's report and UN submit in Rio and discuses many significant threats to sustainable development such as global warming, antibiotic resistant, hazardous materials, chemical, food safety, poverty, aging of population, loss of biodiversity, soil loss, transportation congestion and regional imbalance. Additionally, the EU's *"Draft Declaration on Guiding Principles for Sustainable Development"* go further providing certain policy principles in order to promote sustainable development priorities such as protection of human rights, avoidance of any form of discrimination, poverty alleviation, intra- and intergenerational equity, open liberal democratic society, citizens participation in decision making, promotion corporate social responsibility, cooperation between private and public sector in sustainable production and consumption strategies, policy coherence among local, regional and national policy goals, as well as policy integration.

Many of these policy priorities adapted to the needs of the societal and economic actors in order to change their behavior towards more corporate social responsible (CSR) outcomes to reach the goals of the EU sustainable development goals. From the business side, EU policy has introduced many directives to outline the context of CSR suitable for European businesses to operate (COM/2011/0681). It suggests a triple-bottom-line approach of sustainability as a sufficient context where European businesses should care, for economic growth of societies as well as the preservation of natural resources and the achieving societal cohesion.

Another considerable goal of these directives is to strengthen accountability of businesses towards societies not only for ethical reasons but also for protecting societies from potential risks. The EU's directive (Directive 2014/95/EU) for disclosing non-financial information offers a good-fit for businesses to bridge the information gap between stakeholders and ensure a good degree of accountability for businesses. The EU concludes that CSR is an important strategy for the business community as it contributes to reducing potential social and environmental risks, as well as to achieve cost savings, to guarantee constant access to financial capital and to strengthen the relationships with customers (e.g. trust, satisfactory and loyalty). The benefits of CSR are felt by the economy through new innovation and the value added to economies and societal gains through strengthen of democracy, equity, social capital and better values among their members. Finally, similar to the global trends of sustainable development (e.g. UN, OECD), the EU has adopted the Agenda 2030 for 17 GSDs.

1.2 The policies of the EU in line with Agenda 2030

As mentioned before, the EU has focused on the SDGs of the UN to encourage new policies suitable to protect citizens from poverty, hunger, inequality and environmentally damaging exploitation of natural resources. It is suggested that a complete strategy to protect natural resources through the sustainable consumption and production, and adapt approaches to tackle climate change. Additionally, many prosperity goals have been recognized to make progress in economic, social and technological issues. Finally, a great effort has been made to establish democratic institutions for creating inclusive societies which are based on cooperation and solidarity principles without fear and violence.

In line with this context, the European Commission takes a number of initiatives to stimulate specific policies across Member States. Firstly, it designs policies which are based on the subsidiarity principle of the EU which focuses on achieving the first goal of Agenda 2030 (SDG_1) to end poverty of citizens. It is aimed at offering its Member States suitable tools to efficiently tackle the poverty issues in harmony with the general goals of the socio-economic priorities of Europe 2020 strategy. The auditing of the progress of the first goals of Agenda 2030, Eurostat (2018) suggest two types of indicators: a) multidimensional poverty and basic needs (see details in the following box).

Multidimensional*

- People at risk of poverty or social exclusion,
- People at risk of income poverty after social transfers,
- Severely materially deprived people,
- People living in households with very low work intensity and in work at-risk-of-poverty rate.

Basic needs indicators*

- Population living in a house with a leaking roof, damp walls, floors or foundation or rot in window frames or floor,
- Self-reported unmet need for medical care, population having neither a bath, nor a shower, nor indoor flushing toilet in their household,
- Population unable to keep home adequately warm, overcrowding rate.

*These indicators have been adopted from Eurostat (available at: https://ec.europa.eu/eurostat/cache/metadata/en/sdg_01_10_esmsip2.htm)

In an effort to achieve the second Sustainable Development Goal of an *'end hunger, achieve food security and improved nutrition and promote sustainable agriculture'*, EU suggests a harmony between Agenda 2030 with the basic goals of reformed Common Agricultural Policy (CAP). Essentially, CAP comprises considerable policies suitable for achieving SDG_2 across its Member States through viability of food production (e.g. by maintain agricultural income, improve competitiveness and ensure market stability), promoting sustainable consumption of natural resources and tackling climate change and, finally, securing the rural economy by creating new jobs in farming and agri-food sectors.

In relation to this, a variety of positive aspects within the context of SDG_2 have been achieved through the Common Fisheries Policy (CFP) since necessary circumstances were introduced for creating a sustainable and secure supply chain for food. Except for the general policy rules, it is worth noting that EU offers also a number of financial programs to aid its Member States to align their policies with SDG_2. The following box provides Eurostat (2018) indicators to attend the progress of SDG_2.

- Sustainable agricultural production,
- Agricultural factor income per annual work unit,
- Government support to agricultural research and development,
- Area under organic farming, gross nitrogen balance on agricultural land,
- Adverse impacts of agricultural production Ammonia emissions from agriculture,
- Nitrate in groundwater, estimated soil erosion by water,
- Common farmland bird index, and
- Grassland butterfly index.

*These indicators have been adopted from Eurostat (available at: https://ec.europa.eu/eurostat/cache/metadata/en/sdg_01_10_esmsip2.htm)

Similarly, the EU has put a great emphasis on the third goal of the Agenda 2030 (SDG_3) to *'ensure healthy lives and promote well-being for all at all ages'* by encouraging its Member States to enact suitable legislations and initiatives regarding public health, health systems and environment related health problems (including air quality, chemicals and waste). Some particular policies are referred to *'economic crisis and healthcare: European health strategy'* (well access to healthcare for poor people, health and social care through social work and care home services), *'ensuring the sustainability of Europe's health systems'* (effectiveness of health services, better accessibility for the whole population, health system resilience on rapid changing environment), *'driving patient-oriented innovations in EU health systems'* (a 'life cycle approach' for medicines, health technology assessment strategy, cooperation on prices and costs of new medicines, examine medicines legislation for failures) and *'health for Growth: EU health program (2014-2020)'* (guarantee of citizens from cross-border health risks, and promote sustainability in members states' health systems). The EU has also put emphasis on facing a number of long-lasting diseases, restricting global health risks, and stopping HIV/AIDS. For this goal, Eurostat provide following indicators:

Healthy lives*

- Life expectancy at birth
- Share of people with good or very good perceived health
- Health determinants
- Smoking prevalence
- Obesity rate
- Population living in households considering that they suffer from noise
- Exposure to air pollution by particulate matter

Causes of death

- Death rate due to chronic diseases
- Death rate due to tuberculosis, HIV and hepatitis
- People killed in accidents at work
- People killed in road accidents

Access to health care

- Self-reported unmet need for medical care

*These indicators have been adopted from Eurostat (available at: https://ec.europa.eu/eurostat/cache/metadata/en/sdg_01_10_esmsip2.htm)

Furthermore, in line with SDG_4 (*'ensure inclusive and equitable quality education and promote lifelong learning opportunities for all'*), a number of policies have been suggested by the EU. Many of the European education policies have focused on education and care in early childhood (e.g. rise of students to primary education, better conditions for teachers in early childhood education, and providing advanced financial tools), school policies (e.g. creating new experiences for lifelong learning, exceptional education practices, refugees education, and quality assurance), professional teaching and training (e.g. work-based training, tools for quality assurance, and new abilities), adult education (e.g. extra training programs for adults), higher education, worldwide alliance and policy dialogue (e.g. in order to endorse a network of universities, to make uniform diplomas and student cards), various European languages (to encourage common languages for students in EU) and education programs for refugees and valuation instruments for previous training of refugees and recognition of their experiences. It is worth noticing that an important European initiative is the Erasmus+ programme which encourages and helps all Member States of the EU to exchange educational expertise. Some indicators to evaluate such issues are presented in the next box.

Basic education*

- Early leavers from education and training
- Participation in early childhood education
- Underachievement in reading, maths and science

Tertiary education

- Tertiary educational attainment
- Employment rate of recent graduates

Adult education

- Adult participation in learning

*This indicators have been adopted from Eurostat (available at: https://ec.europa.eu/eurostat/cache/metadata/en/sdg_01_10_esmsip2.htm)

For societal goals of Agenda 2030 (SDG_5 *'Achieve gender equality and empower all women and girls'*; SDG_10 *'Reduce inequality within and among countries'*), the EU put more emphasis on creating suitable conditions for achieving equal opportunities for all European citizens. Principally, the EU have focused on five priorities to balance gender equality through increasing the participation of women in the labour market, enhancing economic freedom between women and men, closing disparity between the genders regarding earnings and pensions, assuring equal involvement of various genders in decision making, ending violence against women, and raising gender equality with citizens. Some indicative indicators to track the progress of such goals are presented in the next box (Eurostat):

SDG_5*

Gender -based violence
- Physical and sexual violence to women experienced within 12 months prior to the interview

Education
- Gender gap for early leavers from education and training
- Gender gap for tertiary educational attainment
- Gender gap for employment rate of recent graduates

Employment
- Gender pay gap in unadjusted form
- Gender employment gap
- Inactive population due to caring responsibilities

Leadership positions
- Seats held by women in national parliaments
- Positions held by women in senior management

SDG_10

Inequalities within countries
- Inequality of income distribution
- Income share of the bottom 40 % of the population
- Relative median at-risk-of-poverty gap
- People at risk of income poverty after social transfers

Inequalities between countries
- Purchasing power
- adjusted GDP per capita
- Adjusted gross disposable income of households per capita
- EU financing to developing countries
- EU imports from developing countries

Migration and social inclusion
- Asylum applications

*These indicators have been adopted from Eurostat (available at: https://ec.europa.eu/eurostat/cache/metadata/en/sdg_01_10_esmsip2.htm)

The protection of natural resources was another significant goal of the European Environmental Policy in the last decades which has been achieved with assistance of various policy tools. The previous experience of the EU in the field of the environment could be a good context to achieve environmental goals of Agenda 2030 (SDG_6: *'Ensure availability and sustainable management of water and sanitation for all'*; SDG_14: *'Conserve and sustainably use the oceans, seas and marine resources for sustainable development'* and SDG_15: *'Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss'*). Some European policies relate to biodiversity protection which put efforts to keep diversity of species and habitats, preserve and restore ecosystems, accomplish sustainably agriculture, forestry and fishing goals, and assist in ending the loss of biodiversity. For water management and sanitation, EU concentrates on assuring safe and hygiene drinking water for all citizens, environmental management of transboundary water resources and coordination management among various economic sectors to guarantee suitable distribution of water resources. Finally, the Common Fisheries Policy promotes appropriate fisheries management (water access rules, fishing safe minimum standards, vessel treatment and technical measures), international policies (international regulations for outside EU fishing policies), market and trade policies (marketing standards and competition rules) and funding policies (EU budget 2021-2027). The next box shows some indicative indicators for the sustainable goals 6, 14 and 15.

SDG_6

Sanitation
- People having neither a bath, nor a shower, nor indoor flushing toilet in their household
- People connected to at least secondary wastewater treatment

Water quality
- Biochemical oxygen demand in rivers
- Nitrate in groundwater
- Phosphate in rivers Freshwater bathing sites with excellent water quality

Water use efficiency
- Water exploitation index

SDG_14

Marine conservation
- Surface of marine sites designated under Natura 2000

Sustainable fisheries
- Estimated trends in fish stock biomass
- Assessed fish stocks exceeding fishing mortality at maximum sustainable yield

Ocean health
- Seawater bathing sites with excellent water quality
- Mean ocean acidity

SDG_15

Ecosystems status
- Share of forest area
- Biochemical oxygen demand in rivers
- Nitrate in groundwater
- Phosphate in rivers

Land degradation
- Artificial land cover per capita
- Estimated soil erosion by water

Biodiversity
- Surface of terrestrial sites designated under Natura 2000
- Common bird index
- Grassland butterfly index

*These indicators have been adopted from Eurostat (available at: https://ec.europa.eu/eurostat/cache/metadata/en/sdg_01_10_esmsip2.htm)

A great emphasis has been placed on consumption and production issues among the EU's Member States. Actually, the twelfth goal of Agenda 2030 (to *'ensure sustainable consumption and production patterns'*) includes various individual policy goals to encourage the business community and consumers to reconsideration their behavior. For instance, some sustainable production European policies are eco-labeling (2010/66/EC), eco-designing (2009/125/EC) and Environmental Management Audit Scheme (EMAS - 2009/1221/EC) which seek out ways to reduce potential environmental impacts of products and services throughout their life cycle. In 2011, an action plan for promoting environmental technologies and innovation policies (2004/0038/EC) have been enacted in full alignment with the basic goals of Europe 2020 strategy. Actually, this eco-innovation strategy aims at highlighting the role of environmental policy in boosting economic growth (the well-known win-win solutions). On the consumption side, many tools have been developed such as the EU footprint for consumption and legislation for promoting sustainable consumption. In the following box, some indicative indicators from Eurostat are presented.

Decoupling environmental impacts from economic growth
- Consumption of toxic chemicals
- Resource productivity
- Average CO2 emissions per km from new passenger cars
- Energy productivity

Energy consumption
- Primary energy consumption
- Final energy consumption
- Share of renewable energy in gross final energy consumption

Waste generation and management
- Circular material use rate
- Generation of waste excluding major mineral wastes
- Recycling rate of waste excluding major mineral waste

*These indicators have been adopted from Eurostat (available at: https://ec.europa.eu/eurostat/cache/metadata/en/sdg_01_10_esmsip2.htm)

Obviously, the EU has put emphasis on facing two modern issues of climate change and renewable energy by accomplishing the seventh and thirteenth goals of Agenda 2030 (SDG_7: *'Ensure access to affordable, reliable, sustainable and modern energy for all'* and SDG_13: *'Take urgent action to combat climate change and its impacts'*). The majority of EU policies on climate change and energy management focus on reducing greenhouse gas (GHG) emissions. This is sought through clean energy policies and tools. In the next box are presented some indicative indicators for these sustainable goals.

SDG_7*

Energy consumption
- Primary energy consumption
- Final energy consumption
- Final energy consumption in households per capita
- Energy productivity
- Greenhouse gas emissions intensity of energy consumption

Energy supply
- Share of renewable energy in gross final energy consumption
- Energy dependence

Access to affordable energy
- Population unable to keep home adequately warm

SDG_13

Climate mitigation
- Greenhouse gas emissions
- Greenhouse gas emissions intensity of energy
- Consumption Primary
- Final energy consumption energy consumption
- Share of renewable energy in gross final energy consumption
- Average CO2 emissions per km from new passenger cars

Climate impacts
- Mean near surface temperature deviation
- Climate-related economic losses Mean ocean acidity
- Support to climate action
- Contribution to the international 100bn USD commitment on climate-related expending
- Population covered by the Covenant of Mayors for Climate and Energy signatories

*These indicators have been adopted from Eurostat (available at: https://ec.europa.eu/eurostat/cache/metadata/en/sdg_01_10_esmsip2.htm)

The social aspect of the EU's objectives at generating suitable circumstances for smart and inclusive economic development. This strategy focuses on achieving the eighth goal of Agenda 2030 (SDG_8: *'Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all')*. Emphasis has been made on the age composition of employees from 20 to 65 years.

Another EU social goal focuses on preparing suitable infrastructure, innovations and financial tools for small types of entrepreneurship. This is also aligned with the ninth goal of Agenda 2030 (SDG_9: *'Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation'*). The following box includes some indicative indicators from Eurostat in order to audit the progress of these goals.

SDG_8*

Sustainable economic growth
- Real GDP per capita
- Investment share of GDP
- Resource productivity

Employment
- Young people neither in employment nor in education or training
- Employment rate
- Long-term unemployment rate
- Inactive population due to caring responsibilities

Decent work
- People killed in accidents at work
- In work at-risk-of-poverty rate

SDG_9

R&D and innovation
- Gross domestic expenditure on R&D
- Employment in high- and medium-high technology manufacturing sectors and knowledge-intensive service sectors
- R&D personnel
- Patent applications to the European Patent Office (EPO)

Sustainable transport
- Share of buses and trains in total passenger transport
- Share of rail and inland waterways activity in total freight transport Average CO2 emissions per km from new passenger cars

*These indicators have been adopted from Eurostat (available at: https://ec.europa.eu/eurostat/cache/metadata/en/sdg_01_10_esmsip2.htm)

As regards SDG_11 *'Make cities and human settlements inclusive, safe, resilient and sustainable'*, EU cities aim at becoming five of the top eight most sustainable cities. With this goal, some of the leading cities in EU are Stockholm, Vienna, London, Frankfurt and Hamburg. Some useful information and guidelines for this purpose are set out in the Urban Agenda of the EU which is a joint effort of the European Commission, Member States and European cities, to strengthen the urban dimension of European and national policies. In line with the UN New Urban Agenda, the EU is strengthening the resilience of urban settings through preparing contemporary cities to tackle potential disasters and climate related risks. The EU Covenant of Mayors for Climate and Energy is a bottom-up local and regional initiative which aims at tackling in an integrated way climate change (through mitigation and adaptation strategies), and offer to citizens better access to secure, sustainable and affordable energy. The following box describes some indicators of Eurostat which is suitable for auditing SDG_11.

Quality of life in cities and communities*
- Overcrowding rate
- Population living in households considering that they suffer from noise
- Exposure to air pollution by particulate matter
- Population living in a dwelling with a leaking roof, damp walls, floors of foundation, or rot in window frames of floor
- Population reporting occurrence of crime, violence or vandalism in their area

Sustainable transport
- Difficulty in accessing public transport
- People killed in road accidents
- Share of buses and trains in total passenger transport

Adverse environmental impacts
- Recycling rate of municipal waste
- Population connected to at least secondary wastewater treatment
- Artificial land cover per capita

Another significant society-based goal of Agenda 2030 is to promote a peaceful and inclusive society (SDG_16: *'Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels')*. To this end, the European Structural and Investment Fund encourages mobility of employees, social inclusion, the fight against poverty and any discrimination and illiteracy problem. Finally, the EU has placed emphasis on increasing global partnership to achieve the goals of Agenda 2030(SDG_17: *"Strengthen Means of Implementation and revitalise the global partnership for sustainable development"*) by enacting certain policies. The following box shows some indicators of Eurostat regarding SDG_16 and SDG_17.

SDG_16

Peace and personal security
- Death rate due to homicide
- Population reporting occurrence of crime, violence or vandalism in their area
- Physical and sexual violence to women experienced within 12 months prior to the interview

Access to justice
- General government total expenditure on law courts
- Perceived independence of the justice system
- Trust in institutions
- Corruption Perceptions Index
- Population with confidence in EU institutions

SDG_17

Global partnership
- Official development assistance as share of gross national income
- EU financing to developing countries
- EU Imports from developing countries

Financial governance within the EU
- Shares of environmental and labour taxes in total tax revenues

*These indicators have been adopted from Eurostat (available at: https://ec.europa.eu/eurostat/cache/metadata/en/sdg_01_10_esmsip2.htm)

1.3 The link between the circular economy and SDGs

The circular economy has gained great momentum as an idea. Many international organizations concentrate on analyzing the content of the circular economy. In reality it is made up of two components: *"circular"* which denotes environmental protection and *"economic"* which certainly refers to financial performance or economic growth. Many point out that the circular economy contributes to sustainable development by creating appropriate economic growth (e.g. resource productivity and cost savings), better working conditions (e.g. new job creation and decent work) and environmental protection (e.g. less use of natural resources and energy dependence).

The concept of circular economy is initially associated with SDG_12 (Schroeder *et al.*, 2019). The circular economy is mainly associated with production and consumption aspects (Figure 2). Many international organizations such as Ellen MacArthur Foundation (EMF) and World Business Council for Sustainable Development (WBCSD) have promoted circular economy principles in order to change traditional business model through reuse, recycle, repurpose, remanufacture, reduce and refurbish of materials. In the same logic, a number of incentives have been suggested to assist consumers in changing their behavior.

However, the circular economy seems also to link with many other goals from Agenda 2030. For example, Cheng *et al.* (2019) identify that the circular economy results in four benefits from pollution elimination, to water resources reducing, to agricultural waste management, and energy savings which could assist in long-term to reduce the double pressures of environment and economic poverty. This is aligned with the first SDG which focuses on no poverty. Furthermore, the UN (2017) have put a target through circular economy to secure natural resources in order developing countries to overcome poverty problems. The Circular Economy could create new chances for employment from new circular business models and of course new opportunities for wage increases.

Furthermore, the circular economy could assist in eliminating waste generated from the food industry and assist in recycling and the reuse of food. It is a potential characteristic which can assist in achieving the second goal of sustainable development (zero hunger). Additionally, new agricultural distribution practices and management for farmers' equipment could help to increase agricultural productivity. It is worth noting that new food production systems through closed-loop techniques are expected to eliminate water consumption and fertilizer utilization.

From the third goal of sustainable development ("ensure healthy lives and promote well-being for all at all age"), there are a number of targets (UN, 2017) which could be achieved through the circular economy such as avoiding hazardous materials in production processes and remanufacturing and repurposeing end of life materials.

The fourth sustainable goal, education of citizens is a significant one. From the circular economy point of view, this implies that all levels of education should introduce lessons on the circular economy not only to prepare students and tomorrows professionals to implement circular economy projects but also to strengthen their knowledge of sustainable development. The circular economy offers the appropriate background to create and reinforce trust among citizens.

The SDG_5 and SDG_10 implies the circular economy will achieve gender equality and avoid other inequalities. This could happen successfully in association with the SDG_12 (responsible consumption and production). The change in the business and consumption model offer opportunities for women and minorities to contribute to the circular economy with many manners. As parts of supply chain of production procedures by feeding businesses with reusable and recyclable materials and as consumers. EMF points out that women play a critical role in the circular economy since they are placed in the center of daily consumption and production and they could promote responsible consumption and production.

Similarly, the circular economy has a positive impact on waste, sanitation and underwater life (SDGs_6 and SDG_14). The EMF (2018) describes three principles of circular economy which could play a critical role in water management. The first circular economy principle is 'design out waste externalities' which is translated as a sufficient tool to improve energy, chemicals and minerals through water systems, better use of sub-basin water resources and use of alternative resources with similar results like water. The second and third principles focus on 'keeping resources in use' and 'regenerate natural capital' which imply optimization of water use.

2

CIRCULAR ECONOMY: CHALLENGES AND BARRIERS

2.1 Circular Economy definition

The circular economy is considered a convenient response for modern societies to exist in linear and limited economic production systems and to offer new products by using scarce natural resources. It is common knowledge that the current linear economic models are limited only to consumption of materials, to convert to products and, finally, to dispose of by-products and residuals in landfill. According to the report of *'liner risk'* (Circular Economy, PGGM, EBRD, KPMG and WBCSD, 2018) highlighted some risks for the business community through linear economic practices which are associated with circular economic regulations (European Commission Circular Economy Packaging), and stakeholders pressure to adopt circular economic practices and market dynamics through creating new environmental conditions for dealing with resource scarcity (new patterns of supply and demand).

Some significant linear features which indicate linear risks for the business community are in the use of non-renewable resources (which implies future resource shortage and price instability), the production of new products (potential losses from recycled products and scarcity of natural resources), the failure to collaborate (potential diffusion of risks into supply chain) and the inability to adapt to new market conditions (difficulty to develop capabilities and resources). The EMF (2015) clarifies the risks of a linear economy as follows:

- **Economic losses and structural waste** which means that material recycling and energy recovery concern only 5% of the original raw material value.
- **Price risks** regarding volatility of price of natural resources as result of their scarcity.
- **Supply risks** which are caused and transferred throughout supply chain and put at risk security and safety of overall supply chain of countries and businesses,
- **Natural systems degradation** through current linear techniques jeopardize future production system and of course societies needs,
- **Regulatory trends** which generate additional adaptation costs for businesses community.

To face such risks, the concept of the circular economy comes as a new type of techno-economic solution in order to assist in preserving natural resources for current and future needs of production and consumption. As previously mentioned, two components of circular economy show environmental preservation through economic benefits. The basic idea is to take back as many as possible end-of-life materials as raw materials in production and consumption stages. This approach aims at closing the loop and shifting a linear economy from *'take – make – waste"* to a circular approach of *"reuse – recycle – remanufacture"* for end-of-life materials.

However, there is no consensus regarding the concept of circular economy. Many organizations and schools of thoughts have introduced definitions for the circular economy. Starting from EMF (2015), three basic principles for circular economy are presented:

- To protect limited natural resources and use renewable resources.
- To optimize resource utilizations in both technical and biological cycles.
- To promote designing system efficacy by avoiding negative externalities.
- Human actions should promote a strong and organized society.
- Human actions should promote health and happiness of society.
- Natural resources should be utilized to produce value.

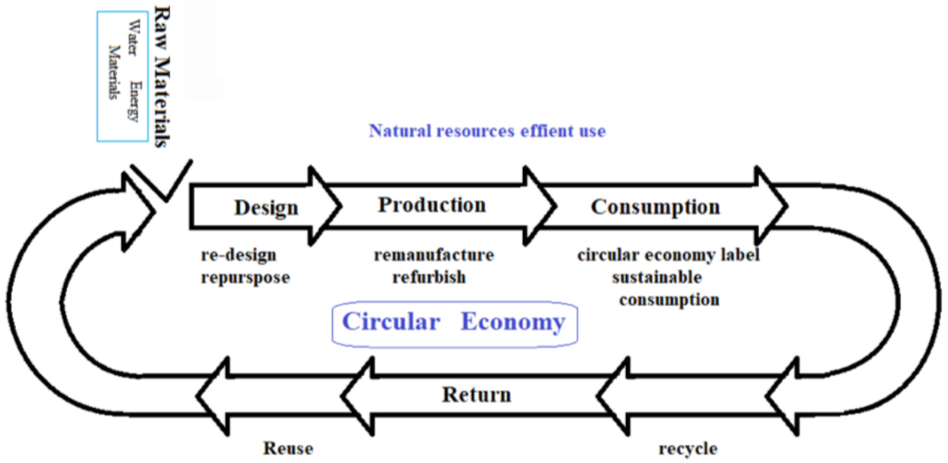
In a more operational approach, The Circular Economy Organization (2014) suggests following circular economic principles:

- Materials should be cycled continually in both technical and biological cycles.
- Energy should be arisen from renewable and sustainable sources.
- Human actions should protect ecosystems and improve the quality of natural resources.

To achieve these goals, a new approach of product design should be adopted by the modern economies such as the level of recoverability of materials, the level of functionality of end-of-life products and materials, the time to develop products, the number of components for production and, finally, the level of integration of materials to other products (Netherland Circular, 2015). Many components have been related to the concept of the circular economy such as: reuse, recycle, remanufacture, repurpose, refurbish, reduce, and redesign (Figure 1).

FIGURE 1

A diagrammatically approach of circular economy



The forward practices aim at changing the designing of products by utilizing eco-design criteria and repurpose the uses of products. At the production stage, many strategies have been suggested to change the raw materials used through remanufacturing and refurbishing practices and, finally, some certain consumption strategies are suggested to change consumers behavior. To support the forward approach, some reverse practices should be adopted such as reuse of and recycling of waste materials.

The concept of the circular economy is not so new but it does appear in the 70s, where the concept of industrial ecology made its first appearance. The origin of the circular economy comes from various scientific fields such as ecology, industrial engineering and environmental economics. Ecology offers insights for various managers and engineers to introduce its circular principles into companies operating (Murray *et al.*, 2017). Erkman (1997) and highlights some general accepted good examples of ecosystems which should be introduced. Two pioneer environmental economists,

Pearce and Turner (1990) stated that the concept of the circular economy is an idea which is contrived from the literature of western countries mainly to explain the necessity for equivalent development between economies and the natural environment.

The Ellen MacArthur Foundation concludes in five schools of thoughts in circular economy:

- **Cradle to Cradle**

  The cradle to cradle idea aims at overcoming the classical linear economy, which puts emphasis on ***cradle to grave*** *for materials. Namely, this approach focuses on eliminating environmental impacts from the stage of extraction of materials from the earth until the stage of reaching by-products in landfill. This idea was devised by Michael Braungart and aimed at designing product components with following characteristics:*

  - Reduce waste materials in production process.
  - Use renewable energy at all phases of production.
  - Protect people and environment at production and conception stages.

- **Performance Economy**

  The Performance Economy looks at identifying certain scientific knowledge to create new smart materials and goods without harming business revenues. Some basic ideas behind performance economy are closed loop production processes, product-life extension, and long-life goods. Some important principles are sufficiency over efficiency and selling performance instead products. The first principle focuses on transforming problems into opportunities and the second principle puts the onus on the consumer to buy performance products rather than linear products. This idea is suggested from Walter Stahel who is an architect and industrial analyst.

- **Biomimicry**

  Biomimicry implies that some scientists adopt principles and functions of nature to solve human problems. It is based on three basic principles:

  - The basic archetype is the nature environment: scientists should study functions of natural environment in order to mimicry them to solve human problems.
  - The natural environment is a good example: scientific solutions towards environmental problems should be combined with ecological standards in order to understand the sustainability outcome of the suggested scientific innovations.
  - The natural environment could be a good guide: this means that natural environmental has much knowledge to give in modern societies and not only natural resources for production processes.

  This idea is inspired by Janine Benyus.

- **Industrial Ecology**

  The term of industrial ecology is very popular since many scientists have been focused on it. The basic idea is that like ecosystem functions result in an efficient operation between the living and non-living components so components of business community could achieve correspondingly successful results. The focus of industrial ecology is on material and energy flows among industries. The final outcome is to close the loop among industries. Some pioneers of this field are Robert Frosch and Nikolas Gallopoulos.

- **Natural Capitalism**

  The basic idea behind Natural capital is that there is a strong interconnection among economy, society and environment. Natural capitalism considers environment as stock of natural assets (e.g. soil, air, water and living creatures), economy as man-made capital and society as human capital (e.g. population).

  Some basic principles of natural capitalism are as follows:

  - Improve natural resources productivity – new design, production and technological procedures can improve productivity of natural resources and offer cost saving solutions.
  - Biologically functions on production – it implies to reduce waste generation through closed-loop production models like natural functions.
  - Service-and-flow business model – it promotes continuous flow of services rather than the traditional sale-of-goods model.
  - Protection of natural capital – some policy is necessary to restore and regenerate natural resources.
  - The relative book is named "Natural Capitalism: Creating the Next Industrial Revolution" which is written from Paul Hawken, Amory Lovins and L. Hunter Lovins.

- **Blue Economy**

  The Blue Economy points out possible benefits through links among environmental problems and open-source scientific solutions. Particularly, it takes into account three aspects of sustainability such as environmental protection, financial benefits and social influences. Actually, the Blue Economy suggests another way to make industrial processes in order to face environmental problems by avoiding using of rare and high-energy cost resources. It presents 21 principles to promote energy issues in relation to the local environmental and physical/ecological characteristics.

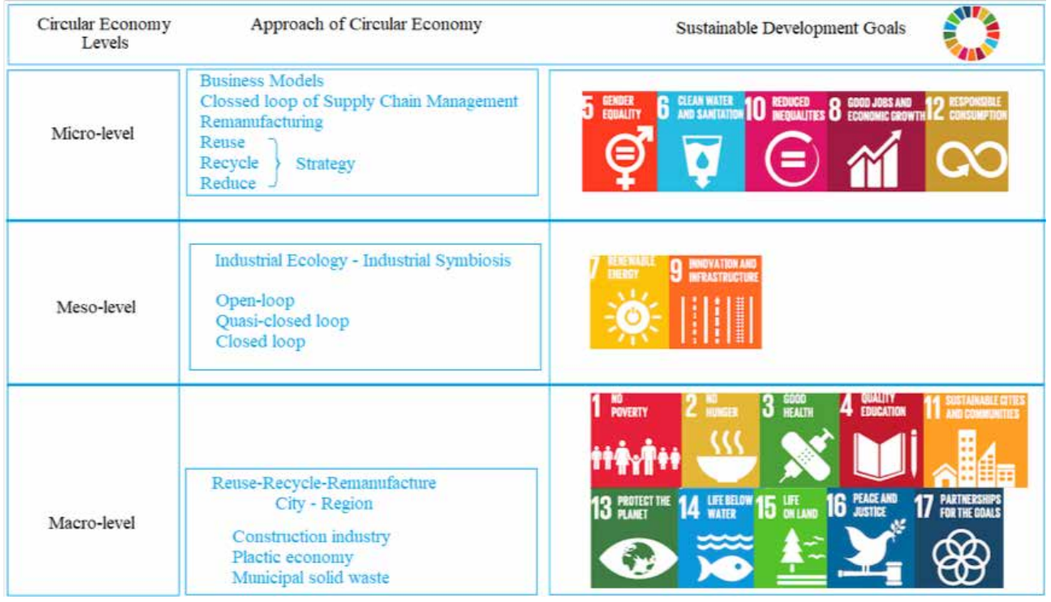
- **Regenerative Design**

  Regenerative design focus on restore and renew individual sources of energy and materials. It takes into account whole system to meet the needs of society through natural resources conservation. This is implemented in a number of sectors such as cities, companies, agriculture and architecture.

The concept of the circular economy is explained by three basic categories such as micro-, meso- and macro-level which are analyzed in the following sub-sections (Figure 2).

FIGURE 2

Three levels of circular economy and sustainable goals



2.1.1 CIRCULAR ECONOMY: THE MICRO-LEVEL

The first significant classification of the circular economy is on the level of an individual company. Essentially, this entails a number of strategies being adopted by individual companies with the intention of achieving the goals in line with the circular economy. One significant line of thought in the literature focuses on circular business models where some significant principles of circular economy have been introduced into the decision-making of companies. The concept of the business model means looking at the way a company generates and brings in value (Antikainen and Valkokari, 2016). A classical circular economy model of companies is the popular closed loop supply chain.

The closed loop supply chain model is made up of two parts. The first one being the forward supply chain management where companies organize all stages of their supply chain with the least environmental impact (Hazen *et al.*, 2017). The second component references the reverse logistics of companies where failed products, residual waste and packaging are returned back for further processing (e.g. reuse, remanufacture and recycle) (Nikolaou *et al.*, 2013). In this model, there are various strategies such as product recovery, remanufacturing operations and market development for remanufactured products (Guide and van Wassenhove, 2009).

Another significant model of the circular economy for companies is the Cradle-to-Cradle (C2C) certification program which sets the five criteria necessary for returning in economy high quality end of life products (e.g. for chemical component, energy and water use). It is suggested that a rating for these materials that helps those interested in using them in remanufacturing, reusing them and then recycling these processes (Franco, 2017).

The EMF proposes a ReSOLVE business model for companies to achieve some basic goals of the circular economy such as regenerate, share, optimize, loop, virtualize and exchange materials in production processes. Some significant approaches to reach the goals of this model include the use of renewable energy and materials, to maximise the use of products, to keep materials in closed loops and, finally, to replace current materials with non-renewable materials (Manninen *et al.*, 2018).

The models suggested have various influences on circular economy goals such as narrowing, slowing and closing the cycle. To achieve some of these goals, individual companies adopt new design procedures

in order to produce long-life goods and product-life extension as well as products post-use strategies. For long-use of products, some strategies suggested are to design for physical and emotional durability. The former implies that the quality of a product deteriorates at a lower rate than similar products and the latter refers to the design of the products need to introduce features which affect the emotions of consumers. Design of products should also take into account maintenance and upgrading options. Maintenance focuses on keeping the functional capabilities of a product constant over time and upgrading means the procedures which improving the current capabilities of products. Finally, design should take into account characteristics such as repair, recycle, refurbish, and remanufacture.

Following this logic, many practices have already been adopted by individual companies to achieve the goals of the circular economy. One classic strategy is to reuse end-of-life materials or packaging. This usually happens with breweries which take back bottles to use them again when bottling new beers. Similar, recycling strategies have been adopted by companies in the context of circular economy. This is differentiated from conventional recycling programs where companies undertake some basic activities such as incinerating, dismantling, and shredding by hiring employees with low skills. In the circular economy, the main goal is to identify highly qualified employees appropriate to accomplish end-to-end process, and separation reusable materials (Goyal *et al.*, 2018).

Today, many companies have adopted remanufacturing practices. Firstly, companies should design new supply chain for materials which should be assimilated with the existing reverse logistic system. Secondly, companies should be developing technical procedures to accomplish remanufacturing. Thirdly, they need to accumulate the appropriate knowledge and understanding in order to create necessary remanufacturing procedures and routines. Finally, suitable marketing should be adopted to promote products and persuade consumers their benefits.

These practices provide various benefits for companies. Some of the largest companies that adopt circular-economic practices have found cost saving advantages. These companies increase their use of renewable energy, the life span of products, improve the efficiency of products, remove waste from the supply chain, close material loops, deliver goods and services, and replace hazardous materials with renewable ones. For example, the automotive industry has made 80% energy savings, 88% in water, 92% less chemical products and, 70% fewer waste production.

2.1.2 CIRCULAR ECONOMY: THE MESO-LEVEL

The second classification of the Circular Economy includes mainly the concept of industrial ecology, industrial symbiosis and industrial metabolism. This basic idea focuses on examining the link between companies in order to be viable. The concept of industrial ecology offers a new way to understand the impact of each industry on each other within their natural environment. Initially, the scope of industrial ecology is to explain and give the business community a new opportunity to utilize the waste of raw materials in production procedures and not as garbage which increase their treatment costs or municipality costs. It examines the relationships between industrial and environmental systems.

Three types of industrial ecology are highlighted such as open, quasi-closed (only energy relationships) and closed-loop (energy and materials exchanges). It is known that environmental harm is an outcome of human activity. Although, there are various definitions with different meaning for industrial ecology, nevertheless some common characteristics are as follows:

- There are systemic relationship between industries and ecological capital.
- There are material and energy flows among companies.
- A multidisciplinary approach is necessary to examine the connection among industry and natural capital.
- A shift from a linear to a closed approach for companies is necessary so as to the by-product of one company is the raw materials to another.
- Strategies to eliminate the negative influences of industrial systems on ecological systems.
- Strategies to integrate industrial activity into ecological systems
- Strategies to make industrial systems more sustainable natural systems

Cooperation between industries is already the basis of the circular economy as the by-products of one production chain are the main components of another. This indicates that companies are interdependent on each other and operate like an ecosystems in which every component is useful for their functions. Industrial symbiosis creates an industrial ecosystem where collaborative companies reach economic, social and environmental benefits. Collaboration between companies aims to face scarcity of resources and the increase in commodity prices. An succeed example is the Klundborg Symbiosis where partners have the following benefits: bottom-line savings of €24 million, €14 million in socio-economic savings, 635,000 tons of CO_2, 3,6 million m^3 water, 100 GWh of energy and 87,000 tons of materials.

2.1.3 CIRCULAR ECONOMY: THE MACRO-LEVEL

The final category is the macro-level of circular economics with efforts focused on entire cities, regions and countries. Today, cities and counties are part of the global economy and supply chains which are based on the linear economy model and they face similar challenges. The linear model is reproduced even more as the global population increases at a rapid rate and demands for natural resources and urban infrastructure increase. To eliminate the negative impacts on natural resources at a city level, they should incorporate circular economic principles across operations by decreasing waste production and returning waste materials to production.

According to the EMF, some significant sectors which cities could focus on are:

- Utilizing healthy materials in order to improve the life of citizens and eliminate the needs for raw materials.
- Promoting energy efficiency in a cost effective way to reduce the burden on households.
- Making urban mobility more available, with lower costs and convenient for citizens.
- The planning of returning nutrients to the biosphere and while minimizing food waste.

EU Urban Agenda has placed circular economy as one of the significant themes. Particularly, several plans have developed to overcome obstacles for a transition from a linear to circular economy in cities. Some opportunities from circular economy plans for cities could be (Urban Agenda for the EU, 2019):

- Creating new jobs:
- Efficiency of local waste management schemes;
- Producing wastewater sludge appropriate feedstock for rural sector;
- Producing valuable ingredients from local organic waste;
- Encouraging industrial ecology among waste and wastewater management sectors in order to product chemicals and plastics;
- Introducing EU targets into local policies in the fields of circular economy, bio-economy, GHG emissions elimination and renewable energy use.

In this logic of circular economy, Amsterdam puts three priorities in order to enable resources and material storage, motivate high –value reuse and encourage materials passports. The first priority emphasizes on the role of municipality in identifying suitable locations for the physical storage of waste and creating the suitable conditions to assist in collecting waste materials. The second priority implies a high-value reuse by supporting public authorities to develop appropriate procurement guidelines with explicit requests for high-value reuse, and informing customer for recycled and reused waste materials. Finally, the municipality has to design material passports for the projects of construction sector. Circle Economy, TNO and FABRIC (2016) classify the seven principles of circular economy in which the city of Amsterdam is based on, as: materials that have technical or biological cycle; utilize renewable sources; resources utilization focusing on creating financial value; flexible design of products that improve resilience of systems; circular business models; and promoting reverse logistics.

Similarly, city of Vantaa (Finland) provides a list of priorities for promoting circular economy goals such as: a) to encourage circular business models, b) to promote circular economy in construction sector, and c) to facilitate circular public procurement and recognizing sharing economy. The City of Hague (Netherlands) also presents the benefits of circular economy transition; carbon emissions have been reduced, while 3,500 jobs have been created in the city of Hague.

The program of OECD (2019) for circular economy in cities and regions puts an emphasis on circular economy indicators. Particularly, it suggests environmental measurement in energy practice, air emissions and hazardous waste, in order to introduce circular economy in several sectors such agriculture, transport, construction, textiles and raw material extraction. Another significant goal of the OECD programs is the promotion of Governance indicators, and developing literature and databases which cover the lack of data and indicators at the city level.

Finally, important tools have been launched by the OECD to encourage and allow countries to adopt circular economy principles. Firstly, a circular economy framework has been designed to promote circular economy with respect to on the economic and social aspects. Secondly, a scoreboard has been proposed, that will evaluate the level of circularity of a city or a region with a focus on innovation, system adjustment, jobs, economic, and operational issues.

2.2 Circular economy barriers and challenges for societies

All institutional documents and research paper highlight the benefits of circular economy for European societies. The benefits are associated with socio-economic and environmental aspects. The socio-economic aspects includes employability in modern economies, such as professional occupations, associate professional, technical, administrative and secretarial staff, circular skilled trades occupations, circular economy process, plant and machine operatives, sales and customer services. The growth of circular economy, can in turn create many new professions (Table 1).

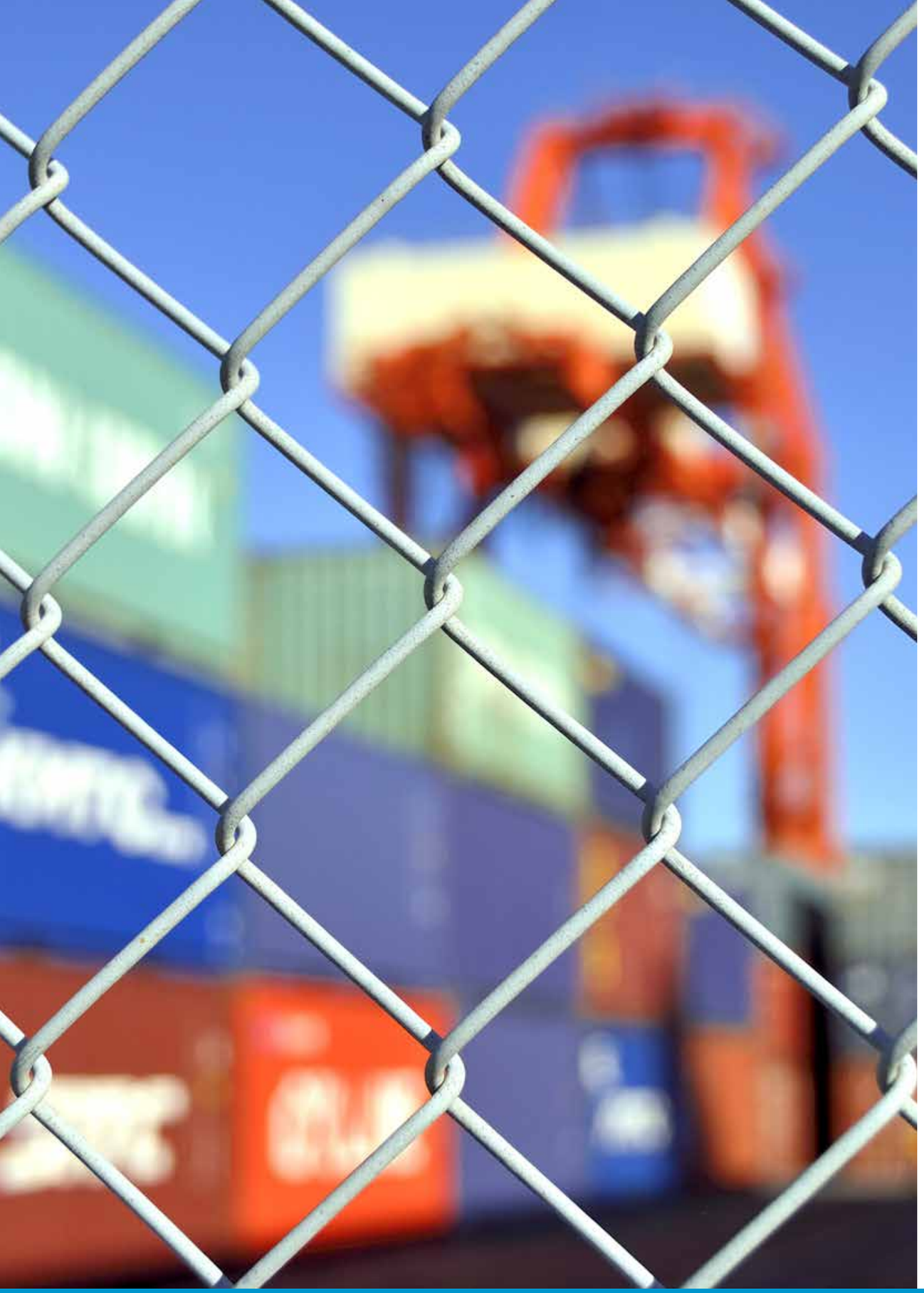


TABLE 1

New jobs in circular economy

CIRCULAR ECONOMY JOBS	DESCRIPTION
Maintenance	Repairing of fabricated metal products, machinery, electronic and optical equipment, electrical equipment;
Maintenance	Maintenance of ships and boats, maintenance of aircraft and spacecrafts, and other transport equipment;
Waste collection and recovery	Waste collection, waste treatment, recovery of sorted materials;
Renting and leasing	Cars, light motor vehicles, trucks, recreational and sporting goods, media entertainment equipment, personal and household goods, agricultural machinery and equipment, construction and civil engineering machinery, office machinery and equipment, passenger water transport equipment, freight water transport equipment, passenger air transport equipment, freight air transport equipment, other machinery, equipment and tangible goods;
Repair	Computers and peripheral equipment, communication equipment, consumer electronics, household appliances, and home and garden equipment, footwear and leather goods, furniture and home furnishings, watches, clocks and jewelry, personal and household goods.

Based on report of WRAP, London Sustainable Development, Greater London Authority and London Waste and Recycling Board (LWARB), 2015

Additionally, circular economy improves labor and resource productivity since less materials are used (UNIDO, Green Growth, 2013). It is estimated that the world economy has gained 40% additional economic value for every tonne of raw materials used in previous years. The productivity of materials could be monitored through the number of repair and re-use centers, the number of circular economy jobs, the volume of recycled raw materials, the amount of circular economy business models, the circular public procurement, and, finally, the use of renewable energy sources. The improvement of resource productivity offers societal welfare gains, in addition to job creation, by improving quality of natural environment. Furthermore, circular economy activities assist societies in creating more inclusive conditions for economic development of companies and households.

Another significant benefit of circular economy is the decoupling of economy from energy and nature resources. This means that less impacts have been made on soil, biodiversity, resource stocks and toxicity of land, water and air. It assists modern societies in eliminating their environmental impacts and improve their ecological footprint. Note that this is a temporary solution that extends the use of natural resources but certainly not a long-term solution to the environmental challenges.

The improvement of ecological footprint of societies could also bring a positive effect on citizens' health. This could imply missing fewer working days and lower impact on productivity, as well as improvement of citizens' quality of life. Additionally, countries eliminate their dependence with regards to future need of raw materials.

However, modern societies face many barriers in adopting circular economy procedures. EMF (2015) classifies the most significant barriers as follows:

TABLE 2

Barriers for circular economy (EMF, 2015)

Economic barriers	Need for further investments.
	Additional innovation needed to reduce costs of circular economy practices.
	Accurate predictions for the cost-effectiveness technology in the long run
Market failures	Externalities from circular economy.
	Unsatisfactory public goods
	Principal – agent problems
	Transaction costs
Regulatory failures	Incomplete legal frameworks
	Weak targets and objectives
	Enforcement failure
	Existing regulation on circular economy practices
Social factors	Absence of capabilities and skills
	Change of consumers habits
	Social opposition

3

POLICY AND FINANCIAL INSTRUMENTS

3.1 Command and Control policy instruments

The first significant policy instrument suitable to shift behavior of the different agents of society and economy (companies and households), from conventional to environmentally friendly approaches, is the well-known *"command-and-control"*. This type of instrument outlines a series of explicit requirements for agents in order to accomplish certain goals in order to preserve environment, and also offers audit mechanisms that control the performance of agents. EU has enacted a number of directives to promote circular economy in Member States. Table 3 shows the stages of circular economy and relevant European legislation.

TABLE 3
Some indicative directives per stage

DESIGN	Production	END-OF-LIFE	CONSUMERS
Directive 2009/125/EC: A context to determine certain eco-design requirements for energy-related products	Best Available Techniques (BAT) Reference Document for Waste Treatment/ Industrial Emissions Directive 2010/75/ EU Integrated Pollution Prevention and control	Directive (EU) 2018/849 and 2012/19/EU on waste electrical and electronic equipmen	Regulation (EU) 2018/848 of the European Parliament and of the Council of 30 May 2018 on organic production and labelling of organic products and repealing Council Regulation (EC) No 834/2007
Regulation (EU) 2017/1369: A context for energy labelling and repealing Directive 2010/30/EU	Best Available Techniques (BAT) Reference Document for the Management of Waste from Extractive Industries consistent with Directive 2006/21/EC	Directive 2006/66/EC on batteries and accumulators and waste batteries and accumulators;	Create a 'Consumption Knowledge Innovation Community (KIC)'
2019/904/EU "reduction of the impact of certain plastic products on the environment (Single-Use Plastics Directive)"	Directive 2012/19/EU on waste electrical and electronic equipment (recast);	Directive 2005/20/EC amending Directive 94/62/ EC on packaging and packaging waste;	Establish a Consumer Insights strand of work within the European Circular Economy Stakeholder Platform Coordination Group
	Directive 2011/65/EU on the restriction of the use of certain hazardous substances in electrical and electronic equipment	Directive 2000/53/EC on end-of-life vehicles;	

In the stage of product design, directives suggest certain necessities for energy-related products with the aim at contributing to sustainable development through increasing energy efficiency, protecting natural environment and ensuring the security of energy supply. It offers also motives for small and medium-sized enterprises (SMEs) to incorporate environmental criteria such as energy efficiency measurement and waste remanufacture, in the phase of designing products. Some of the eco-design criteria include better selection and use of raw materials, reduction of manufacturing and environmental impact, limited use of packaging, transport, and distribution, improvements in

installation and maintenance, and end-of-life strategy for packaging. Outstanding mention has been made in foreseeing the needs of materials, energy and other resources, the negative impacts on air, water and soil, noise pollution, vibration, and radiation, the production of waste material and the opportunities for reuse, recycling and recovery of materials and energy. Another important points of such directives focus on weight and volume of the product, use of recycling materials, consumption of energy and water throughout the life cycle, use of hazardous substances, number of recycled materials and components used, time necessary for disassembly, use of material coding standards suitable for reuse and recycling, integration of used materials, extension of lifetime of raw materials use, eliminate greenhouse gases, acidifying agents and volatile organic compounds, impacts on water and soil.

In the production phase, Best Available Techniques provides various solutions for eliminating industrial environmental impact. In particular, these BAT conclusions cover the following issues: overall environmental aspects of the industry, water consumption, collection and treatment of solid waste, treatment of waste sludge, gas waste, flaring, emissions of volatile organic compounds, odor emissions and noise emissions. Particularly, in order to increase businesses' environmental profile, BAT suggests a complete environmental management system (EMS), that helps achieve the following goals: a) commitment with businesses' executive boards b) defining environmental policies, c) development of the required procedures, objectives and targets, d) implementation of procedures including internal structure and employees' responsibilities, training programs, as well as environmental legislation analysis, e) internal monitoring, measurement, maintenance of records, independent and external auditing system, f) act procedures to correct potential system failures.

In the end-of-life phase, many directives have been suggested to assist collection, treatment and recycling. For example, the battery directive (*2006/66/EC*) offers a context to collect, treatment, recycling and disposal of batteries and accumulators. This focuses on increasing batteries' environmental performance and accumulators by suggesting appropriate collection schemes for portable batteries and accumulators. These schemes encourage end users to remove portable batteries or accumulators at specific collection points and distributors to recollection such batteries at no charge. Similarly, Directive (2000/53/EC) aims at avoiding waste from vehicles and increasing reusing and recycling of end-of life vehicles. The main goal of Directive is to promote the reduction of end-of-life components and their disposal of waste, while it looks for improving all economic agents' environmental performance in overall supply chain. Finally, Directive (94/62/EC) put emphasis firstly on preventing the production of packaging waste and secondly on reusing and recycling packaging.

Finally, emphasis has been given on the side of consumers who act either as environmentally concerned citizens who contribute to the return of end-of-life packaging, or as consumers who need to buy new types of (recycled and reused) products. Some typical difficulties include the absent of knowledge on the side of consumers regarding circular economy, as well as identifying the benefits in buying such products. Essentially, many of the consumers who have participated in EU surveys have stated that they need better information regarding product characteristics and the procedures of repairing products.

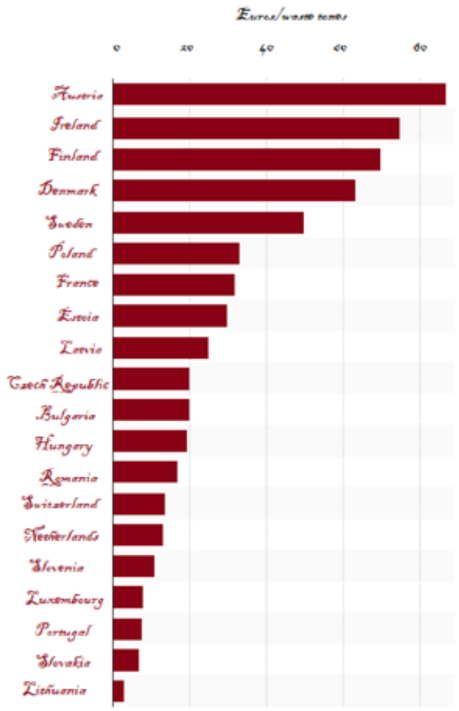
3.2 Market-based instruments

The second category of policy instruments includes the popular market-based instruments which assist economic and social actors in changing their behavior and participating in a circular economy. This category implies instruments with influences mechanism of the prices (e.g. demand and supply mechanism). Actually, market-based instruments aim at altering the behavior of companies and households in order to eliminate waste, as well as to provide new financial opportunities. The European Commission has enacted a series of taxes and charges in order to curb waste production such as:

- **Landfill charges**

  Landfill charges in order to dispose non-hazardous waste in legal landfill sites: There are different types of charges such as a) for construction and demolition waste b) for packaging waste (Packaging Directive); c) for municipal waste; and d) for household disposal.

FIGURE 3
EU landfill taxes (Euro/tones)



- **Incineration taxes and fees**

  Incineration of waste is an EU priority as Directive 94/67/EC, 89/369/EEC and 89/429/EEC showcase. Such directives aim at reducing negative effects of incineration of waste procedures on the natural environment such as a, soil, water and groundwater pollution. According to the directives incineration plants are classified in two general categories. The first category includes incineration plants which utilize the thermal treatment of waste with recover heat generated by combustion. The second category includes co-incineration plants with cement, lime kilns, steel plants, and power plants. These focus on energy generation and the production of material products.

- **Pay-as-you-throw schemes**

  Pay-as-you-throw programs add a charge to residents for the collection of municipal solid waste; Households pay based on the side of their waste disposal while in traditional waste management systems households pay a fixed tax. There are different pay-as-you-throw taxes which are calculated as follows (Troltzsch *et al.*, 2012):

  - Citizens pay for all the waste gathered when they purchase a traditional bag, bin or particular size container;
  - Municipalities enforce a maximum number of bags and the waste containers;
  - A two-part tax with a flat fee that creates revenue stability and a fee for the additional waste.

- **Producer responsibility schemes for specific waste streams**

  One popular term in relative literature is the Extended Producer Responsibility. The reasoning behind EPR is that it adds the burden on polluters and offers an opportunity to producers to internalize any environmental externalities, mainly in the stage of product design (to avoid future costs) or to internalize future benefits from end-of-life waste management.

The European Union has adopted three relative Directives to promote EPR; Directive 2000/53/EC, WEEE Directive 2012/19/EU and the Batteries Directive 2006/66/EC. It is worth noting that EPR is mentioned in the Packaging and Packaging Waste Directive (94/62/EC).

OECD research shows that there are 400 EPR systems currently in operation and the majority of such systems are mandatory and enforced by legislation. However, there are many barriers for producers to adopt voluntary EPR systems. Many producers have limited know-how and financial capital to adopt EPR, as there is no guarantee for consumers' demand for environmental-friendly products. Such systems seem to have more benefits for public authorities and consumers as the basic principle behind EPR is to shift financial responsibility from municipalities and citizens to producers.

3.3 Green, circular economy and Public Procurement

Public procurement is a significant developmental tool for modern economies. In recent decades there has been a growing demand in using public procurement as a tool to promote innovations and economic growth. The EU considers public procurement as a major driver for economic growth and innovation since almost 14%-16% of the EU GDP is available through public procurement and in order to further benefit from public procurement, the EU promotes a series of strategic priorities such as economic, social, innovative and green procurement.

In order to participate in public procurements private companies need to meet the requirements of Public Authorities that introduce appropriate criteria. Therefore, any producer or supplier can participate in Public Procurement only if they meet all the criteria and offer competitive price in relation to other suppliers. The EU has set a series of environmental criteria in order for companies to participate to the Green Public Procurement (GPP). In order for GPP to be an effective tool for economy growth and environment protection, some well-defined environmental criteria for products and services should be put be put in place. The EU provides GPP criteria for a range of products such as organic products, fish and marine products from depleted stocks, plant-based menus, food waste, single-use items, and energy and water consumption in home appliances.

Similarly, the EU has suggested circular criteria to introduce in GPP and three types of models that are appropriate for implementing Circular Procurement (CP): a) system level (e.g. product service system, Public-Private Partnership, cooperation with other organizations on sharing and reuse, rent/lease, supplier take-back systems including reuse, recycling, refurbishment and remanufacturing), b) supplier level (supplier take-back system, strategy to disassembly, reparability of typical products, outside reuse/ sale of products, inside reuse of products) and c) product level (selection of materials in the product, disassemble of products after use, recyclable materials, resource efficiency, and recycled materials). The system level focuses on the contractual techniques in order for Public Authorities to ensure circularity of their purchasing behavior that involves supplier take-back agreements in order to remanufacture, re-use and recycle. The supplier level model defines the way which suppliers can incorporate the concept of circularity into their systems and processes, so as to guarantee that the products and services meet circular the procurement criteria.

3.4 Voluntary circular economy instruments

One significant category of tools in environmental economic and management field is the voluntary efforts of economic actors to solve environmental problems by generating economic benefits (win-win solutions). Investors and firms recognize five types of environmental risks including climate change, regulatory risks, reputational risks due to the absence of environmental strategies, litigation risks associated with non-compliance to environmental legislation and finally, supply chain risks. Either in order to identify new opportunities or in order to avoid potential risks, companies adopt circular economy practices. A first

category of such tools includes circular economy labels which ensure that companies or products achieve circular economy principles. One popular certification system is the “Cradle to Cradle” which includes a worldwide accepted measurement method; in order to comply with this certification, products are evaluated for five environmental and social criteria such as material health, material reuse, renewable energy and carbon management, water stewardship, and social fairness.

The EU considers that existing European labels promote circular economy. Firstly, the EU Eco-flower label facilitates the transition to a circular economy through a sustainable production and consumption, through rewarding manufacturers who select to adopt design procedures for durable and repairable products. The EU Eco-flower label promotes products and services with lower environmental impact throughout their life cycle with energy savings, durability and repairability. Similarly, EMAS is a tool that improve the environmental performance of companies. The European Commission considers EMAS as one of the tools that assist companies and organizations to meet the principles of the Circular Economy. EMAS provides suitable procedures for companies to save money and resources by cutting waste and material use, and increasing water and energy efficiency.

Another circular economy label is the e-Stewards Certification, a global program which encourages organizations that desire to dispose of their old electronic equipment to identify recyclers that comply with the highest standard of environmental responsibility and worker protection.

4

EU AND GREECE: A COMPARATIVE ANALYSIS

4.1 The analysis of current status of Greece for circular economy and Agenda 2030

Based on voluntary reports of Greece regarding SDGs (2018), it seems that serious attempts have been made to comply with the 17 SDGs. Particularly, Greece has set its policy priorities regarding 17 SDGs as follows:

- **Sustainable economic growth**

  Greek policy has focused on four priorities to achieve SDG 9. The first priority includes a new production model for high value-added and knowledge-intensive goods and services. The second priority aims at improving the image of Greek businesses in order to strengthen their export orientation. The third priority supports the capacity of domestic production. The final priority seeks to encourage clusters among businesses to facilitate them to face international competition of large businesses.

- **Increase in employment**

  Employment increase (8 SDGs) is a key priority in Greece, given the high unemployment rates observed in the country compared to other European countries (25%). To make working conditions more humane, a significant initiative was to adopt the International Labour Organization (ILO) Recommendation regarding the transition from an informal to a formal economy. The Greek government has also adopted a series of initiatives to strengthen employment such as:

  - Public Work Schemes are useful to protect employment to high risk long-term unemployed persons, and reincorporating them into the labor marketplace by helping them acquire new work experience and skills.

  - Youth Employment schemes to assist the transition of young people into the labor market. It offers the opportunities to young people to acquire work experience and entrepreneurial spirit.

  - Social and Solidarity Economy, that further promotes economic development, employment and social cohesion.

  - Defending Labor Rights by promoting health and safety programs at work and improvement the skills of employees in sustainable jobs.

4.2 Facing poverty, social exclusion, and exclusion from health care services

In alignment with the Sustainable Development Goals 1, 2 and 3, Greece has designed programs to tackle poverty, unemployment and social exclusion. Social solidarity income has enacted to guarantee

a minimum income for all Greek citizens. Welfare is another important policy to help households that experience extreme poverty to face economic problems and social exclusion. Furthermore, suitable conditions have been created in order to provide all citizens with access to quality health care by offering free access to the public health care system. Finally, programs have been designed to promote mental health and well-being, to increase health financing and recruitment of health workforce, and, finally, to reduce maternal and child mortality.

4.3 Decrease social and regional inequalities and guarantee equal opportunities for all citizens

Many significant actions have been adopted by the Greek state to improve living standards, social and income inequalities. Such conditions result from geographical disparities in Greece (mountainous and insular areas), and the lack of efficient resources and adequate infrastructure that help overcome various social and economic problems. Such geographical differentiations are confronted through integrated policies for the disparities of insularity and regional development. Particularly, three goals of insular policy have been put in place, including institutional measures, vital infrastructure for water and energy sufficiency, and policies to financially support small-island communities.

State policies have also focused on social inclusion for immigrants. Immigration policy has further aimed at harmonizing the coordination of current formal actions such as first reception of third country citizens, asylum claims, immigration and social inclusion. Finally, important policies have been enacted to promote fair treatment of women, and protect from discrimination in the workplace and from domestic violence.

4.4 Providing high-quality and inclusive education

Education of citizens is a significant goal of sustainable development (SDGs 4) and is considered the foundation of other SDGs. Greek policies focus on generating and sharing knowledge within people and modern societies. Greek educational programs aim at improving results, reducing inequality, and creating new knowledge and skills for the labor market.

Another significant priority is to improve higher education. The Greek government had made significant efforts to ensure that all citizens and residents are able to have access to education, including refugees, migrants and non-greek speaking residents. This also contributes to developing skills for employment and decent jobs, and fosters inclusive education at all levels, including a pilot informational program for Roma population, and the Muslim minorities. The focus of Greek educational programs is to provide knowledge and skills for people to be global citizens, and strives to ensure education quality and lifelong learning for youth, in order to prepare well-educated people with access to the global job market.

4.5 Protection of the natural capital and promotion of a low-carbon economy

To protect natural resources, the Greek government has set a number of priorities to strengthen the principles of democracy, good governance, inclusive institutions, and to protect vulnerable persons and create conditions for economic stability and environmental protection. These policy priorities aligned with SDGs goals 6, 7, 11, 12, 13, 14, and 15. In more detail, these policies promote European policy priorities such as the circular economy, through new patterns for production and consumption. These patterns have been placed in the core of policy priorities for sustainable consumption and production, which are paired with a range of voluntary tools for SMEs, large firms and entrepreneurs.

4.6 Structure effective, accountable and transparent institutions

To strengthen capacity and quality of its institutions, the Greek State has enacted mechanisms to protect human rights, fight corruption, and build effective and transparent institutions.

4.7 Improving open, participatory, democratic processes

Policies that aim at promoting values of democratic and participatory governance, aligning with SDGs 16 and 17. To this end, three main initiatives have been undertaken including electronic polls and debate, open calls for tenders and for the recruitment of public administration officials, and OpenGov procedures.

4.8 Circular Economy in Greece

Circular Economy in Greece include financing tools and a series of regulatory frameworks. These policy tools aim at connecting small and medium-sized enterprises and the social economy with technological innovation, and to improve governance and networking procedures (HRMEE, 2018).

In particular the suggested financial tools aim at offering sufficient financial capital to entrepreneurs to adopt circular economy practices. An outstanding significance has been given on promoting and improving small-scale entrepreneurship and social economy. The use of transnational European funding mechanisms, as well as series of amendments in Greek investment law are necessary in order to make circular economy successful. It is worth noting that the Greek circular economy policies have also focused on promoting investments in infrastructure in ports and islands, as well as on creating well-designed circular tax incentives. To this end, some tax adjustments are bound to be introduced for recyclable and secondary materials.

Further to that, institutional tools in waste management, production, consumption, and secondary raw material are often used in order to reform the Greek regulatory regime in the context of circular economy. This is accompanied by amendments and adaptations of the current legislative framework (e.g. amendments on waste management). Another significant institutional priority is the national framework for promoting Green Public Procurements. Other priorities of Greek policy have focused on the characterization and classification of waste in categories such as secondary raw materials and re-usage materials from wastewater and sludge. It further outlines innovative applications and technologies for waste management in the context of the National Research and Innovation Strategy for Smart Specialization (RIS3).

To audit circular economy frameworks and processes, the Greek government has put forward a set of indicators, as part of a methodology to monitor food waste, apply criteria for ecological design, national standards for the circular economy, and in introducing the elements of circular economy into environmental impact assessment. Greek policies have also placed emphasis on regional context by promoting maintenance services and consulting services. It also creates re-use centers, new regulatory frameworks to encourage the production of green gas from organic waste, and promotes the bio-economy sector and its institutional framework at the local level.

4.9. Comparative analysis Greece and EU

4.9.1 COMPARATIVE ANALYSIS OF EU MEMBER STATES FOR SDGS

Many of EU countries have designed a comprehensive strategy for achieving the goals of sustainable development. One third of the EU Member States have adopted sustainable development strategies quite early, and most of them following the 2002 Johannesburg World Summit on Sustainable Development including Germany, Italy, Poland, France, Slovakia, Austria, the Netherlands and Lithuania. Estonia Finland, Malta, Czech, Spain, and Portugal followed. However, it is surprising that a small number of EU Member States, such as Sweden, Ireland, and Luxemburg, have adopted a complete plan for sustainable development even before 2002.

It is worth noting, that a large number of EU Member States have already aligned their own sustainable development programs with SDGs. The analysis of Member States' institutional documents shows that various approaches have been utilized in their efforts to introduce the SDGs into previous sustainable development strategies. A number of countries have aligned their national development plans and growth programs with goals of sustainable development (SDGs). Finland and Germany adjusted its sustainable strategies with SDGs, while Italy has broadened their current environmental-oriented sustainable development with social and economic goals.

Another significant task for the EU Member States is coming up with auditing system to study the progress of SDGs adoption. Actually, many Member States have designed a system of regular progress to report and follow up information regarding SDG implementation. For example, Denmark and the Netherlands audit the progress of SDG on an annual basis. Latvia and Sweden have designed auditing systems to examine positive and negative points from implementation of SDGs. On the other hand, Finland and Italy have commissioned the auditing of SDGs progress to independent organizations.

The majority of the EU Member States (70%) have updated their quantitative information regarding the SDGs. They have adopted relevant circular economy indicators of Eurostat in order to draw uniform indicators suitable for comparative analysis among other Member States. Against the practice of the many EU Member States France and Finland have opted to design national indicators in order to audit the progress of SDG adoption. Furthermore, Italy and Belgium have placed emphasis on the connection between Gross Domestic Product (GDP) and SDGs adoption.

Figure 4 shows that the majority of the 28 EU Member States have adopted various priorities regarding 17 SDGs. An important finding shows that most Member States have politically committed and developed a sustainable development strategy. It is crucially important that all Member States have enacted procedures to coordinate various sustainable development goals. A great emphasis has been also made from EU Member States for stakeholder participation and information tools to promote sustainable development goals. A small number of Member States have developed procedures for institutions, and formal procedures through national parliaments.

FIGURE 4
Priorities for Sustainable Development for 28 European Member States

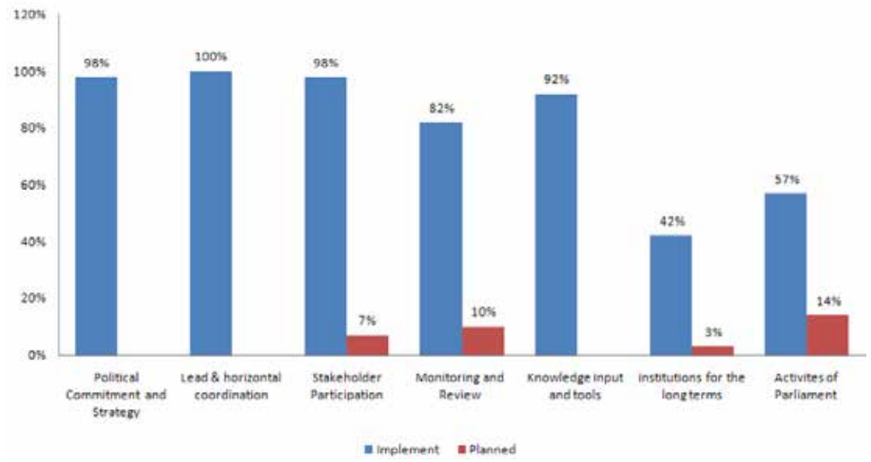
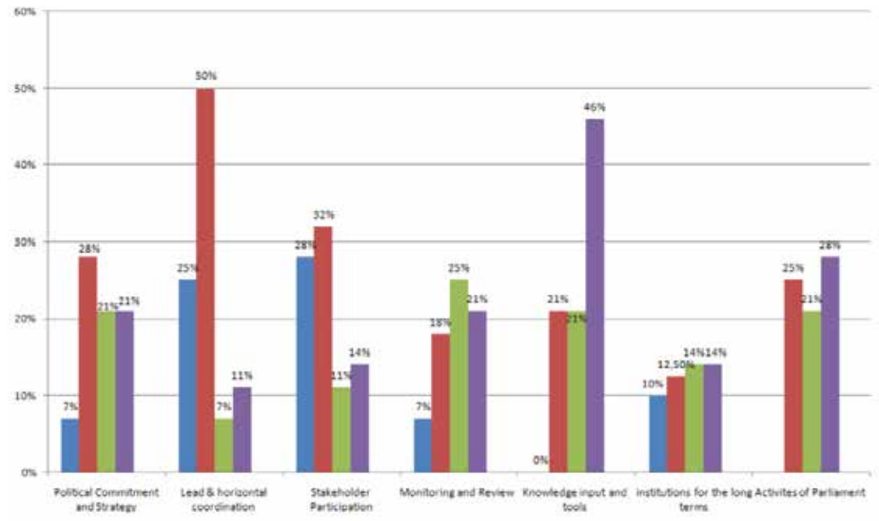


Figure 5 indicates the completeness of sustainable development priorities for EU Member States. The findings show that only 7% (blue) of EU Member States have achieved 100% of the goals in political commitment priority. The majority of the EU have achieved 75% of the goals (red). The rest of the sampled Member States have achieved 50% (green) and 25% (purple) of the priority. Similarly, the second priority (lead & horizontal) has been achieved 100% from 25% of the EU Member States and 75%, 50% and 25% from 50%, 7% and 11% correspondingly.

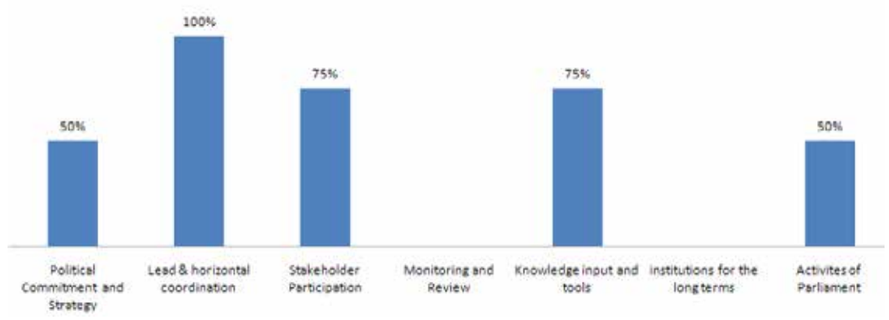
FIGURE 5
Completeness of SD priorities per European Member States



Finally, Greece has prepared a complete plan with procedures in place that ensure horizontal coordination for SDGs and a relative complete plan for stakeholder participation and information tools.

Finally, in terms of its political commitment Greece has only managed to achieve half of the sustainable development goals, without having procedures in place for monitoring and review.

FIGURE 6
Greece and Agenda 2030 goals



4.9.2 CIRCULAR ECONOMY

Circular economy creates new opportunities for entrepreneurs since it is estimated that over 150 billion euro value is created across EU Member States. The investments for circular economy investments are estimated to over 18 billion euro, with a significant part of such investments being related to recycling of municipal solid waste. However, it is important to point out that circular economy products have low demand.

The European Commission has been developing a monitoring system to examine the progress of circular economy for each Member State. The monitor system includes four categories of information: a) sustainable production and consumption, b) waste management, c) secondary materials and d) competitiveness and innovation. The sustainable consumption is furthermore categorized in four sub-categories with indicators to measure EU self-efficiency for raw materials (36.4% of total raw materials), Green public procurement, waste generation of municipalities (486 kg per capita), waste excluding major minerals waster per GDP unit (65 kg per thousand euro), waste excluding major mineral waste per domestic materials consumption (13.5%) and food waste (80 in mass unit).

The second dimension of waste management includes two general categories of indicators to measure recycling and recovery rates. The former category estimates recycling rate for municipal waste (46.4%) as well as for all waste excluding major mineral waste (57%). The latter category includes recycling rate of overall packaging (67%), for plastic packaging (41.9%), for wooden packaging (40%), for e-waste (1.4%), for biowaste (81%) and for recovery rate of construction and demolition waste (89%).

The category of secondary raw materials is monitored through two further categories of indicators. The first category estimates contribution of recycled materials to raw materials demand which shows that 2.4% of end-of-life materials are recycled and 11.7% of circular economy materials are used in production processes. The second category includes trade in recyclable raw materials through imports form non-EU countries (5.917,284 products codes), exports to non-EU countries (37.111,276 product codes) and intra EU trade (53.000 products codes).

The final set of indicators regarding competitiveness and innovation draws suitable information through private investments and patents. Particularly, the first dimension (competitiveness) is monitored through gross investment in tangible goods (0.12% of GDP), persons employed (1.69% of total employment) and value added at factor cost (1% of GDP). The second dimension (innovation) is audited through a number of patents.

Finally, indicators regarding circular economy show high waste production and slower progress in circular economy through innovation and competitiveness. In particular, Greece has an average 504 kg in municipal waste per capita, 78% per GDP waste, excluding major mineral waste, and 11.5% waste excluding major mineral waste per domestic material consumption. Additionally, recycling rates remain low: 18.9% recycling rate of municipal waste, 68.6% recycling rate of overall packaging, 41.4% recycling rate of plastic packaging, 20.4% recycling rate of wooden packaging, 32.9% recycling rate of e-waste and 21% recycling rate of biowaste. In terms of competitiveness and innovation, the Greek private investment accounts for 0.05% of GDP, the value added as factor costs is at 0.36% of GDP and only 1.52% of total employment is a result of circular economy.

5

CONCLUSIONS AND DISCUSSION OF POLICY ISSUES

Circular economy is a new concept which aims at contributing to sustainable development of modern economies through increasing competitiveness, innovation and less environmental impact. This report analyzed the current status of circular economy and sustainable development in light of Agenda 2030. Agenda 2030 today offers a modern context with 17 goals for countries and organizations in order to make advancements in their economies, their natural environment and societies, and to help them ensure continual, efficient, quality and safely economic and social development.

By presenting relevant information regarding the performance of EU Member States in adopting circular economy and Agenda 2030, and by completing a short comparative analysis between EU and Greece, a series of interesting questions have arisen.

One significant concern of this report focuses on examining the appropriateness of existing policy tools to direct modern economies to introduce circular economy and sustainable development principles into their formal policy with practical results on economic development, innovation and competitiveness. This analysis is based on the well-known context of environmental policy tools such as *'command and control'* and *'market based instruments'*.

Under normal conditions, well-defined regulations could drive businesses and consumers to take actions to preserve natural environment. On the one hand, businesses could adopt circular economy strategies and Agenda 2030 to reach the goals of modern societies. Circular economy strategies could assist businesses to gain future benefits or avoid potential social and economic risks. For instance, good businesses sustainable development performance assists in improving corporate profile and relationship with stakeholders who play a critical role in their viability. Additionally, improved sustainability performance could reduce businesses' financial risks since they avoid potential regulatory and litigation risks arising from environmental legislation. On the other hand, consumers are positively affected from the suggested policy tools, either as price of products drops or as quality of products' improves.

It is important to mention that one of the weaknesses of these policy tools is that they have been only tested for environmentally friendly products and environmental business models, which appear to differ from circular economy products, business models and SDGs. Environmentally friendly products are more widely accepted than circular economy products by consumers, since new products are often associated with pathogenic organisms. Thus, some new policy tools could be necessary to shift businesses and consumers to circular economy.

However, the debate remains on whether legislative or financial tools are effective for encouraging businesses and consumers to shift into the circular economy. The general experience has shown that legislation has sometimes helped businesses to innovate and exploit new opportunities, but in other cases legislation can also act as a barrier for businesses. The results seem to be better from market-based instruments despite criticism for their violation of key legislative principles such as *"polluter pays"* (e.g. subsidies). Maintaining these benefits should be certainly associated with market forces, that is, supply and demand.

Another significant issue is the crowding out of the conventional economy thanks to circular economy. Care should be taken during the transitional phase of transforming the conventional mode of production in a way that incorporates the principles of the circular economy. A change without a precise policy could endanger Europe's economies in the short run, as other major economies will continue to produce in the conventional way with no adjustment costs.

Several challenges and opportunities have arisen from circular economy for small economies such as Greece. This type of economy first faces the difficulties of converting the conventional production model as it is difficult to find cash and properly qualified personnel. Financing challenges are even greater due to the severe impact that the economy has had in the last decade, but also as the size of the economy does not allow it to have a leading role in the circular economy, instead to follow the practices of the major European countries and the policies set by the European Union.

REFERENCES

Antikainen, M., & Valkokari, K. (2016). A framework for sustainable circular business model innovation. *Technology Innovation Management Review*, *6*(7), 5-12.

Becker J. Niemann M. and Halsbenning S., Contribution to Growth. European Public Procurement. Delivering Economic Benefits for Citizens and Businesses, Study for the Committee on the Internal Market and Consumer Protection, Policy Department for Economic, Scientific and Quality of Life Policies, European Parliament, Luxembourg, 2018. Available at https://www.europarl.europa.eu/RegData/etudes/STUD/2018/631048/IPOL_STU(2018)631048_EN.pdf (8.12.2019).

Brundtland, G. H., Khalid, M., Agnelli, S., Al-Athel, S., & Chidzero, B. (1987). Our common future. *New York*.

Cheng, H., Dong, S., Li, F., Yang, Y., Li, Y., & Li, Z. (2019). A circular economy system for breaking the development dilemma of 'ecological Fragility–Economic poverty'vicious circle: A CEEPS-SD analysis. *Journal of cleaner production*, *212*, 381-392.

Circle Economy, TNO and FABRIC, 2016. CIRCULAR AMSTERDAM A vision and action agenda for the city and metropolitan area https://www.circle-economy.com/wp-content/uploads/2016/04/Circular-Amsterdam-EN-small-210316.pdf

Circular Economy, 2014. Facility Management in a Circular Economy, available at *https://www.circle-economy.com* (28.11.2019)

Circular Economy, PGGM, EBRD, KPMG and WBCSD, 2018. Linear Risk, Publication Report, available at https://www.circle-economy.com/wp-content/uploads/2018/06/FINAL-linear-risk-20180613.pdf (27.11.2019).

Cole, H. S. D.; Freeman, Christopher; Jahoda, Marie; Pavitt, K. L. R., eds. (1 April 1973). *Models of Doom: A Critique of the Limits to Growth* (1st, hardcover ed.). Universe Publishing. ISBN 0876631847.

COM/2011/0681, A renewed EU strategy 2011-14 for Corporate Social Responsibility, available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52011DC0681&from=EN (12.12.2019).

Directive 2014/95/EU of the European Parliament and of the Council of 22 October 2014 amending Directive 2013/34/EU as regards disclosure of non-financial and diversity information by certain large undertakings and groups Text with EEA relevance

ECOTEC, CESAM, CLM, University of Gothenburg, UCD and IEEP, 2019. Final Report: Ch10: Landfill Taxes, available at: https://ec.europa.eu/environment/enveco/taxation/pdf/ch10_landfill.pdf (8.12.2019).

EMF, 2015. Growth within: a circular economy vision for a competitive europe , Available at: https://www.mckinsey.de/files/growth_within_report_circular_economy_in_europe.pdf. (1.12.2019).

EMF, 2015. Towards a circular economy: Business Rationale for an accelerated transition, Ellen MacArthur Foundation, available at: https://www.ellenmacarthurfoundation.org/assets/downloads/TCE_Ellen-MacArthur-Foundation_9-Dec-2015.pdf (27.11.2019)

EMF, 2018. Water and Circular Economy, available at: https://www.ellenmacarthurfoundation.org/assets/downloads/ce100/Water-and-Circular-Economy-White-paper-WIP-2018-04-13.pdf (10.12.2019)

Erkman, S. (1997). Industrial ecology: an historical view. *Journal of cleaner production*, *5*(1-2), 1-10.

European Commission, 2017. Public Procurement for a Circular Economy: Good practice and guidance, available at https://ec.europa.eu/environment/gpp/pdf/Public_procurement_circular_economy_brochure.pdf (8.12.2019).

Eurostat, 2018. Sustainable Development in the European Union — Monitoring report on progress towards the SDGs in an EU context, ISBN: 978-92-79-72287-5 Digital Object Identifier (DOI): 10.2785/237722

Franco, M. A. (2017). Circular economy at the micro level: A dynamic view of incumbents' struggles and challenges in the textile industry. *Journal of cleaner production*, *168*, 833-845.

Frosch, R. A., & Gallopoulos, N. E. (1989). Strategies for manufacturing. *Scientific American*, *261*(3), 144-152.

Goyal, S., Esposito, M., & Kapoor, A. (2018). Circular economy business models in developing economies: lessons from India on reduce, recycle, and reuse paradigms. *Thunderbird International Business Review*, *60*(5), 729-740.

Guide Jr, V. D. R., & Van Wassenhove, L. N. (2009). OR FORUM—The evolution of closed-loop supply chain research. *Operations research*, *57*(1), 10-18.

Hazen, B. T., Mollenkopf, D. A., & Wang, Y. (2017). Remanufacturing for the circular economy: An examination of consumer switching behavior. *Business Strategy and the Environment*, *26*(4), 451-464.

Hellenic Republic, 2018. Voluntary national review on the implementation of the 2030 Agenda for sustainable development, available at: https://sustainabledevelopment.un.org/content/documents/19378Greece_VNR_Greece_2018_pdf_FINAL_140618.pdf (9.12.2019).

HRMEE (Hellenic Republic Ministry of Environment & Energy), 2008. National circular economy strategy, available at: http://www.ypeka.gr/LinkClick.aspx?fileticket=pYSLQXgjjOU%3D&tabid=37&language=en-US (10.12.2019).

Jenkins, V. (2002). Communication from the Commission: A Sustainable Europe for a Better World: A European Union Strategy for'Sustainable Development'[Commission's Proposal to the Göteborg European Council].

Manninen, K., Koskela, S., Antikainen, R., Bocken, N., Dahlbo, H., & Aminoff, A. (2018). Do circular economy business models capture intended environmental value propositions?. *Journal of Cleaner Production*, *171*, 413-422.

Matsumoto, M., & Umeda, Y. (2011). An analysis of remanufacturing practices in Japan. *Journal of Remanufacturing*, *1*(1), 2.

Murray, A., Skene, K., & Haynes, K. (2017). The circular economy: an interdisciplinary exploration of the concept and application in a global context. *Journal of Business Ethics*, *140*(3), 369-380.

Netherland Circular, 2015. The potential for high-value reuse in a circular economy, available at: https://www.circulairondernemen.nl/uploads/27102a5465b3589c6b52f8e43ba9fd72.pdf (28.11.2019).

Nikolaou E.I., Evangelinos K. and Allan S., 2013. A reverse logistics social responsibility evaluation framework based on the triple bottom line approach, *Journal of Cleaner Production*, 56 (1), 173-184.

OECED, 2016. Extended Producer Responsibility Guidance for efficient waste management, available at: https://www.oecd.org/environment/waste/Extended-producer-responsibility-Policy-Highlights-2016-web.pdf (8.12.2019).

Passell, Peter; Roberts, Marc; Ross, Leonard (1972-04-02). "The Limits to Growth". *New York Times*. Retrieved 2 December 2017.

Pearce, D. W., & Turner, R. K. (1990). Economics of natural resources and the environment. Hemel Hempstead, Herts: Harvester Wheatsheaf.

Prendeville, S., & Bocken, N. (2017). Design for remanufacturing and circular business models. In *Sustainability Through Innovation in Product Life Cycle Design* (pp. 269-283). Springer, Singapore.

Schroeder, P., Anggraeni, K., & Weber, U. (2019). The relevance of circular economy practices to the sustainable development goals. *Journal of Industrial Ecology*, *23*(1), 77-95.

Sneddon, C., Howarth, R. B., & Norgaard, R. B. (2006). Sustainable development in a post-Brundtland world. *Ecological economics*, *57*(2), 253-268.

Troltzsch J., Watkins E.; Hogg D.; Mitsios A., Mudgal S and Van Acoleyen M., 2012: Use of Economic Instruments and Waste Management Performances. Final report prepared for the European Commission – DG Environment.

United Nations. (2017). Tier classification for global SDG Indicators.

Urban Agenda for the EU, 2019. Survey report on regulatory obstacles and drivers for boosting a sustainable and circular urban biobased economy, available at webpage:https://ec.europa.eu/futurium/en/system/files/ged/survey_report_on_regulatory_obstacles_and_drivers_urban_circular_bioeconomy_final_version_20.11.19_0.pdf, (2.12.2019).