

# European environment policy for the circular economy: Implications for business and industry stakeholders

By Mark Anthony Camilleri<sup>1</sup>, University of Malta, Malta AND University of Edinburgh, Scotland.

**How to Cite:** Camilleri, M.A. (2021). European environment policy for the circular economy: Implications for business and industry stakeholders. *Sustainable Development*, <https://doi.org/10.1002/SD.2113>

This is a prepublication version.

## Abstract

European Union (EU) institutions and agencies are increasingly raising awareness on the circular economy agenda. They are encouraging marketplace stakeholders to engage in sustainable production and consumption behaviors by reducing, reusing, restoring, refurbishing and recycling resources in all stages of their value chain. Therefore, this research evaluates the latest European environmental policies including its 'new circular economy plans for a cleaner and more competitive Europe'. Afterwards, it presents a systematic literature review that is focused on the circular economy in the EU context. The findings suggest that there are a number of opportunities as well as challenges for the successful planning, organization, implementation and measurement of circular economy practices for sustainable supply chains in Europe. This contribution identifies key implications and provides reasonable recommendations to policy makers and industry practitioners.

**Keywords:** circular economy, environmental policy, circular economy strategy, sustainable production, sustainable consumption, European Union, sustainability, policy.

---

<sup>1</sup> Department of Corporate Communication, Faculty of Media and Knowledge Sciences, University of Malta, MALTA. Email: [mark.a.camilleri@um.edu.mt](mailto:mark.a.camilleri@um.edu.mt) AND The Business School, University of Edinburgh, SCOTLAND.

## **1. Introduction**

The manufacturing industries have customarily followed a linear economic approach (Michelini, Moraes, Cunha, Costa & Ometto, 2017; Bonciu, 2014; EU2014a; EMF, 2013). They procure their resources from the natural environment through extraction and mining to make products and components (Kirchherr, Reike & Hekkert, 2017; EU, 2015a; EMF, 2013). Eventually, the consumers would purchase their products and will dispose of them when they have reached their end of life (Hao, Wang, Wu, Sun, Wang, & Cui, 2020; Camilleri, 2019a; Ghisellini, Cialani & Ulgiati, 2016; EU, 2014a). Very often, the manufacturing industries' as well as the consumers' waste is dumped in landfills or incinerated (Luttenberger, 2020; Kirchherr et al., 2017; Haas, Krausmann, Wiedenhofer & Heinz, 2015; Scharff, 2014). These unsustainable practices are triggering significant changes in our natural environment and biospheres, with catastrophic consequences for human life (Bell, Paula, Dodd, Németh, Nanou, Mega, Campos, 2018; Leipold & Petit-Boix, 2018). Therefore, business and industry are encouraged to embrace the circular economy strategies that are designed to use, reuse and reduce their dependence on resource depleting systems, that are usually characterized by high externalities, including emissions and waste generation (Unger, Beigl, Höggerl & Salhofer, 2017; EU, 2014a; EMF, 2013).

The circular economy fosters sustainable production and consumption behaviors as practitioners improve their operational efficiencies and reduce waste (EU, 2020a, 2020b; 2014; Stål & Jansson, 2017). The sustainable consumption of resources was recently listed as one of the priority areas of the European Green Deal as the European Union (EU) has also recognized the importance to reduce the mining of natural resources (Smol, Marcinek, Duda & Szoldrowska, 2020; EU, 2020a). Currently, the national economies are reliant on the extraction of natural resources as they provide crucial materials for the manufacturing of products (Goto & Sueyoshi, 2020). The increase in the global extraction of resources is driven by higher living standards and from major infrastructural

investments that are happening in developing and transitioning countries (EU, 2020b; Zhang, Hassan & Iqbal, 2020). The rise of rapid urbanization within the emerging economies is expected to intensify the competition for certain raw materials and to destroy our natural environment (Huang, Chen, Su & Wu, 2020; Rodrigues & Franco, 2019). Eventually, this can (it already has in some parts of the world) a devastating effect on our global climate (Salvini, Dentoni, Ligtenberg, Herold & Bregt, 2018). The projections are that the demand for the world's resources including biomass (like fruit and vegetables), fossil fuels (like gas, oil or coal), metals and minerals would more than double between 2015 and 2060 (UNEP, 2019; OECD, 2019a; Leipold & Petit-Boix, 2018). Hence, there is scope for governments and policy makers to promote the business case for the circular economy. They can incentivize practitioners to invest in circular economy systems to enhance their operational efficiencies and cost savings, whilst reducing waste and emissions (EEA, 2018; Haas et al., 2015).

This contribution builds on relevant theoretical underpinnings and empirical studies. Specifically, its objective is twofold. Firstly, it scrutinizes the European environmental policies, including its latest EU (2020) circular economy plan for cleaner production systems and sustainable supply chains. Secondly, it presents a systematic review on 'circular economy' and 'European Union' through Scopus' indexed publications.

## **2. Background**

The "circular economy" notion is increasingly being used by politicians, business practitioners and even by civil societies (Smol, Kulczycka, Henclik, Gorazda & Wzorek, 2015). This term is associated with recycling and/or better waste management systems (Luttenberger, 2020; Ferronato, Rada Gorrity, Portillo, Cioca, Ragazzi, Torretta, 2019; Gregson, Crang, Fuller & Holmes, 2015).

Its proponents suggest that circular eco-designs and closed loop systems can lead to significant improvements in terms of cleaner production systems, responsible supply chains and operational efficiencies (Bocken, de Pauw, Bakker & van der Grinten, 2016). Therefore, there is scope for business and industry practitioners to implement circular economy strategies and to find ways how to reduce their resource consumption, thereby minimizing the generation of waste and unwanted externalities (Smol, Kulczycka & Avdiushchenko, 2017; Quina, Soares & Quinta-Ferreira, 2017; Tisserant, Pauliuk, Merciai, Schmidt, Fry, Wood & Tukker, 2017; Haas et al., 2015). Very often, intergovernmental and governmental institutions are incentivizing their circular economic practices. For instance, the European member states are following the EU's (2014b) directive on nonfinancial disclosures, among others, as they disclose material information on their environmental, social and governance performance (Venturelli, Caputo, Leopizzi & Pizzi, 2019; McDowall, Geng, Huang, Barteková, Bleischwitz, Türkeli, Kemp & Doménech, 2017; Camilleri, 2018; 2015).

### **3. The European Union's Environmental Policy**

The European Union Commission (EU) has reiterated its commitment to implement its 2030 Agenda for Sustainable Development to protect the natural environment, to decrease land degradation and prevent the loss of bio-diversity, by reducing its reliance on the use of natural resources (EU, 2020a; 2020b). The Commission's latest plan provides a comprehensive account about the current situation and discusses about the opportunities and challenges for various actors across the globe. It emphasizes that its success is dependent on the stakeholders' active engagement to achieve its European Green Deal<sup>2</sup> (EU, 2020a; Salem, Shawtari, Shamsudin & Hussain, 2018; Yau, 2012).

EU's (2020b) circular economy policy plan envisages that it would create more than 700,000 jobs by 2030 (this was announced a few days before the outbreak of the 2019-2020 Coronavirus - COVID19). This document is aimed at making the European economy even more sustainable, as the Commission is pushing its member countries to exploit the untapped potential of green product life cycles. This is congruent with another European strategy, entitled 'Farm to Fork' (this is another component of the European Green Deal), that is focused on agriculture, aquaculture and sustainable food production. Specifically, this policy covers the entire food supply chain. Its underlying goal is to reduce the usage of resources and unnecessary externalities by promoting the sustainable production and consumption of food. One of its key objectives is to contribute towards achieving a circular economy by introducing policies that are meant to reduce the businesses' environmental impact (Patricio et al., 2018). For example, the retail and food production industry sectors can implement the EU's proposed changes by minimizing the transportation, storage, packaging of products and waste (EU, 2019a).

The objectives of both the circular economy and F2F strategies are to reduce waste. The measures from the circular economy plan are meant to reduce the use of packaging and over-packaging. At the same time, it encourages the businesses and their customers to use and re-use resources as well as recycled materials. EU (2020b) delineates the Commission's circular economy plan for cleaner production systems and sustainable supply chains concerning: batteries and electric vehicles; construction and buildings; electrical and electronic equipment; food, water and packaging; nutrients; plastics and textiles, among other resources.

### **3.1 Batteries and electric vehicles**

The EU has introduced a batteries directive in 2006. Since then, there were a number of revisions in this directive. EU (2020a, 2020b) has reiterated its commitment to increase the collection and recycling of used batteries from European states. It also emphasized the importance to phase out non-rechargeable batteries. The Commission is also pushing the automotive industry to adhere to its CO<sub>2</sub> emission standards to reduce its carbon footprint. It is encouraging the European vehicle owners to purchase Lithium-ion powered, electric vehicles. The responsible mining and extraction of this metal will be required to achieve zero-emission mobility, climate neutrality and technological leadership. In this light, in 2017, the EU has launched the European Battery Alliance to create a sustainable value chain for the production of lithium batteries for vehicles. Recently, there were oversupply concerns, as COVID19 has led to a drop in the price of lithium. This issue may result in more demand for this white metal.

### **3.2 Construction and buildings**

EU (2020b) has put forward its recommendations for the circular economy practices within the building, construction and demolition industry sectors. It has promoted the circularity principles to improve the durability and adaptability of buildings throughout their lifecycle. The document proposed that the construction industry should have reasonable targets to recover demolition waste and unwanted materials. At the same time, it made reference to safety issues, the functionality of material recovery and on the sustainability performance of construction products (Jiménez-Rivero & García-Navarro, 2017). The Commission has always promoted green initiatives like reusing excavated soils in order to reduce the sealing of the soils, and to rehabilitate any abandoned or contaminated brownfields (Vandecasteele, Marí, Rivero, Baranzelli, Becker, Dreoni, Lavallo & Batelaan, 2018).

A quarter of all the European waste comes from the construction and building industry (EU, 2019b). Such waste can be prevented by reusing building components for the same purpose for which they were conceived (Tam & Lu, 2016). The rubble and low-grade recovery waste like crushed cement or stones can be used for road works. However, in practice, it may prove very difficult to reuse scrapped steel, glass, aluminum and wood, for the very same purpose for which they were conceived (Smol et al., 2015). Currently, the used materials from demolished buildings are not suitable to reuse or to refurbish for construction purposes (EEA, 2020). Notwithstanding, the cost to re-use construction material can be affected by: national and local circumstances; mismatch of supply and demand; as well as by logistical issues, like moving materials over long distances (Jiménez-Rivero & García-Navarro, 2017; Smol et al., 2015). Moreover, the builders may be reluctant to re-use construction materials that lack an adequate certification of tested performance from a recognized authority. The testing of the building materials can be expensive as it involves thorough analyses of samples to mitigate the risks of further usage. Such costs will be added to the material costs for the builders and may possibly override any savings from the reuse of extant material (Veleva & Bodkin, 2018).

### **3.3 Electrical and electronic equipment**

Year after year, the information and communication technologies, including electronic equipment and appliances are generating more waste that finishes in landfills. The EU is recycling less than 40% of such waste streams (EU, 2020a; Unger et al., 2017). The electrical and electronic waste (WEEE) comprise computers, printers, televisions, refrigerators, mobile phones, tablets and laptops, among other technologies. Their materials and components are made from scarce, hazardous resources. For example, the smartphones' components include very precious and rare

metals like gold, silver, copper, platinum and palladium. The mining and extraction of these metals has an impact on the natural environment at local, regional and global scales, as biodiverse ecosystems are destroyed through waste spills and pollution (Kemp & Owen, 2018). The electrical and electronic materials can even create health issues if they are not collected, treated and/or recycled in an appropriate manner (Unger et al., 2017).

In this light, the EU's Directives were intended to restrict the use of heavy metals or to improve their retrieval and recycling after their use (see WEEE, 2002 and ROHS, 2002; 2012). In 2012, the Commission revised its directives to address the increased waste that was generated by EEEs (WEEE, 2012; ROHS, 2012). Hence, EU member states are expected to collect and report data on the electrical and electronic products that are sold, collected, recycled and recovered (EU, 2020c; EU, 2019c).

### **3.4 Food, water and packaging**

The food value chain and its generated waste is also having a negative effect on the natural environment. EU (2008) has proposed a target to reduce food waste in its Farm-to-Fork Strategy (see EU, 2019a, 2019d). EU (2020a) has reaffirmed its commitment to address this matter. For example, its Drinking Water Directive (EU, 2019d) was intended to make tap water drinkable and accessible in public places, in order to reduce the production of bottled water and its packaging waste. This recent document has also raised awareness about its previous directive on reusable and recyclable packaging of materials and products (See EU, 1994). In 2017, the waste from packaging materials accounted to 173 kg per inhabitant. However, this figure is poised to increase, year after year (EU, 2019d).



EU (2020b) specified that the Commission's prospective sustainable products initiative will direct businesses and consumers to ban single-use packaging, plastic cutlery and tableware. These items are conspicuous in fast-food services. EU (2020a) could restrict the packaging of materials and pave the way for more reusable, sustainable products.

### **3.5 Nutrients**

EU (2019e) anticipated that its Integrated Nutrient Management Plan shall stimulate the markets for recovered nutrients. This document specified that the EU's Water Reuse Regulation encourages European farms to reuse water for agricultural purposes (EU, 2019e; Unay-Gailhard & Bojnec, 2019; Salvini et al., 2018). The Commission is assessing the possibility to treat sewage sludge and secondary water (Kacprzak, Neczaj, Fijałkowski, Grobelak, Grosser, Worwag, Rorat, Brattebo, Almås & Singh, 2017; Smol et al., 2015).

Recently, the Farm Sustainability Tool (FaST) was developed to help farmers manage the use of nutrients in their farm. This application (app) (which is free of charge) was proposed in the framework of the Good Agricultural and Environmental Conditions (GAECs) and is part of the latest common agricultural policy (CAP) proposals for 2021-27. In a nutshell, this technology ought to improve the competitiveness and environmental sustainability of the European farms (Unay-Gailhard & Bojnec, 2019). FaST can be accessed through a personal computer and via smart devices including smart phones and tablets. It provides useful data about the farms' resources, including crops, soil, animals, manure, et cetera, among other issues. This app can support farmers on how to improve crop fertilization, reduce nutrient leakages in ground water or rivers; increase soil quality and reduce greenhouse gas emissions (EU 2019e). Moreover, the tool will help to decrease the use of nutrients and/or to increase crop yield. In both cases, this will lead to enhance

the farmers' revenues and operational efficiencies. A few EU countries are already customizing the functions and services of FaST to ensure that it is adapted to the local conditions, whilst taking advantage of the extant knowledge (EU, 2019e).

### **3.6 Plastics**

The manufacture of plastic is increasing the demand for petrochemicals, as they make up 99% of all plastics. For decades, oil and gas companies have created markets for their by-products and/or managed them as waste streams (OECD, 2019b).

It takes more than 400 years to degrade plastic. However, its utilization has increased at the rate of 4% a year, since 2000 (WEF, 2019). To date, just 12% of plastic waste has been incinerated, and just 9% has been recycled (National Geographic, 2017). Notwithstanding, this material carries a carbon footprint when burned. Hence, most plastics still exist in landfills or in our natural environments (Scharff, 2014). Thus, European governments have imposed severe restrictions on the use of plastic bags (EU, 2020b). These measures were followed by considerable reductions of such waste in the citizens' litter. As a result, there was also less plastic in marine environments (Earthwatch Institute, 2019).

Currently, the EU's research agenda is focused to investigate the presence of microplastics in food and beverages. The European Parliament had emphasized that the prevention of plastic waste should be one of the Commission's first priorities (EP, 2018). Other European entities and stakeholders have pointed out that reducing the use of this material is required to improve the natural environment as well as the individual citizens' health and wellbeing. EU's (2020a) clarified that it is planning to introduce more stringent legislative instruments to eliminate single-use food

packaging. The commission recommended that manufacturers should use biodegradable and recyclable packaging for their products (EU, 2019f). There are several stakeholders, including governments, intergovernmental organizations and non-governmental organizations in different contexts, that are increasingly calling for the reduction of plastic products (EU, 2020; EU, 2019f; EASAC, 2020; UNEP, 2020; UNEP, 2018; OECD, 2019).

### **3.7 Textiles**

The production of clothing, footwear and household textiles necessitate primary raw materials and water. Specifically, the textile industry is ranked as the second highest in terms of land use and it is fifth with regards to greenhouse gas emissions (EEA, 2019). The processes to produce textiles require large amounts of different chemicals. Furthermore, the washing of textiles also release chemicals and microplastics into household wastewater (Monea, Löhr, Meyer, Preyl, Xiao, Steinmetz, ... & Drenkova-Tuhtan, 2020). Therefore, the textile industry is affecting our natural eco-systems in every phase of its production processes (Stål & Jansson, 2017; Hu et al., 2011). Very often, the textiles are exported to the developing countries, incinerated, or landfilled, as their recycling remains very low (EEA, 2019; Scharff, 2014).

EU (2015b) had recognized that the textile industry as a priority area in one of its latest documents. This year, the Commission is proposing a comprehensive EU Strategy for Textiles. EU's (2020a) suggests that the manufacturers of textile materials ought to follow eco-designs and sustainability measures to ensure that they are engaging in closed loop systems. Such systems would require that they use and reuse resources, tackle the utilization of a wide variety of chemicals, empower the businesses and their consumers to opt for the re-utilization of textiles and repair facilities (Monea et al., 2020; EU, 2020a).

#### **4. Data Capture**

The previous section presented a review of the latest European policies including regulatory guidelines, instruments and principles relating to the circular economy agenda. It examined the EU's key propositions for the production and consumption of batteries and electric vehicles, construction and buildings, electrical and electronic equipment, food, water and packaging nutrients, plastics and textiles, among other items (EU, 2020a, 2020b).

The second part of this contribution features a systematic review that was carried out through Scopus-indexed publications. The researcher captured, analyzed and synthesized the articles' content, including their research questions, methodologies and interpretation of the findings. The search results from the systematic research was focused on those publications that had featured the words 'circular economy' and 'European Union' in article titles, abstracts and keywords, up to June 2020.

There were 329 contributions that were listed in Scopus' indexed publications (122 of them were open-access). The first contribution (a journal article) on this topic was published in 2011 (see Sakai, Yoshida, Hirai, Asar, Takigami, Takahashi, ... & Douvan, 2011). To date, there were 267 contributions (out of 329) that appeared in academic journals. Their top 10 subject areas were related to: environmental science (218), social sciences (88), energy (86), engineering (71), business, management and accounting (43), economics, econometrics and finance (38), materials science (25), agricultural and biological Sciences (21), chemical engineering (20) as well as earth and planetary sciences (14). Table 1 presents a list of twenty-four (24) contributions that had more than 30 citations in Scopus. This table endorses the contributing authors, describes their research approaches, and features the keywords of their articles.

**Table 1. The most cited articles on the circular economy within the European Union context**

<b>Authors</b>	<b>Year</b>	<b>Research type</b>	<b>Keywords</b>
Ghisellini P., Cialani C., Ulgiati S.	2016	Review (Conceptual)	Circular economy; resource efficiency; reuse; recycling; zero waste; sustainability.
Korhonen J., Honkasalo A., Seppälä J.	2018	Review (Conceptual)	Circular economy; business strategy; scientific research; global net sustainability; thermodynamics; system boundaries; six limitations.
Haas W., Krausmann F., Wiedenhofer D., Heinz M.	2015	Review (Conceptual)	circular economy; energy transition; industrial ecology; material flow accounting; recycling; sustainable resource use.
Kacprzak M., Neczaj E., Fijałkowski K., Grobelak A., Grosser A., Worwag M., Rorat A., Brattebo H., Almås Å., Singh B.R.	2017	Empirical (Comparative Analysis)	Sewage sludge; Waste management; Wastewater treatment plants; LCA.
Gregson N., Crang M., Fuller S., Holmes H.	2015	Review (Case Studies)	circular economies; recycling; resource recovery; anaerobic digestion; waste.
Smol M., Kulezycka J., Henclik A., Gorazda K., Wzorek Z.	2015	Empirical (Comparative Analysis)	Circular economy (CE); construction materials; utilization; sewage sludge; sewage sludge ash (SSA).
Kirchherr J., Piscicelli L., Bour R., Kostense-Smit E., Muller J., Huibrechtse-Truijens A., Hekkert M.	2018	Empirical (Surveys and Interviews)	Circular economy; sustainability transitions; sustainable development; barriers; European Union.
McDowall W., Geng Y., Huang B., Barteková E., Bleischwitz R., Türkeli S., Kemp R., Doménech T.	2017	Review (Conceptual)	China; circular economy; environmental governance; European Union; indicator; industrial ecology.
Sakai S., Yoshida H., Hirai Y., Asari M., Takigami H., Takahashi S., Tomoda K., Peeler M.V., Wejchert J., Schmid-Unterseh T., Douvan A.R., Hathaway R.,	2011	Empirical (Comparative Analysis)	3R; recycling; waste management; international comparison; policy developments.

Hylander L.D., Fischer C., Oh G.J., Jinhui L., Chi N.K.			
Tisserant A., Pauliuk S., Merciai S., Schmidt J., Fry J., Wood R., Tukker A.	2017	Empirical (Comparative Analysis)	circular economy; consumption-based accounting; industrial ecology; multiregional input-output; municipal solid waste; waste input-output.
Quina M.J., Bontempi E., Bogush A., Schlumberger S., Weibel G., Braga R., Funari V., Hyks J., Rasmussen E., Lederer J.	2018	Review (Case Studies)	Municipal solid waste; incineration; fly ash; air pollution control residues; recovery; toxic metals
Lazarevic D., Valve H.	2017	Review (Document Analysis)	Circular economy; expectations; narratives; transition.
Ranta V., Aarikka-Stenroos L., Ritala P., Mäkinen S.J.	2018	Empirical (Comparative Analysis)	Circular economy; institutional theory; regulation; norm; cultural-cognitive; case study.
Smol M., Kulczycka J., Avdiushchenko A.	2017	Review (Conceptual)	Circular economy; eco-innovation; regional policy; sustainability indicator; waste reduction.
Bell J., Paula L., Dodd T., Németh S., Nanou C., Mega V., Campos P.	2018	Review (Conceptual)	European bioeconomy; European Commission; bio-based economy; blue bioeconomy; circular economy; sustainable development goals.
Moraga G., Huysveld S., Mathieux F., Blengini G.A., Alaerts L., Van Acker K., de Meester S., Dewulf J.	2019	Review (Conceptual)	Circular economy; indicators; sustainability; life cycle thinking.
Ferronato N., Rada E.C., Gorrity Portillo M.A., Cioca L.I., Ragazzi M., Torretta V.	2019	Empirical (Comparative Analysis)	Circular economy; developing countries; European framework; recycling behavior; solid waste management; sustainability.
Michelini G., Moraes R.N., Cunha R.N., Costa J.M.H., Ometto A.R.	2017	Review (Conceptual)	PSS; sustainable business model; circular economy; product-service systems.

Jiménez-Rivero A., Sathre R., García Navarro J.	2016	Empirical (Sensitivity Analysis)	Gypsum plasterboard; European Union; material flow analysis; life cycle assessment (LCA); primary energy; GHG emissions.
Scharff H.	2014	Empirical (Case Study)	Zero landfill; diversion; reduction; circular economy.
Milios L.	2018	Review (Conceptual)	Circular economy; resource efficiency; policy.
Bonciu F.	2014	Review (Conceptual)	Development paradigm; linear economy; circular economy; European economy; spirit of our times.
Leipold S., Petit-Boix A.	2018	Mixed Methods (Document analysis and Participant Observation Data)	Bioeconomy; circularity; transition; business models; innovation.
Quina M.J., Soares M.A.R., Quinta-Ferreira R.	2017	Empirical (Comparative Analysis)	Industrial eggshell; ca-rich waste; animal by-product; valorisation options; anthropogenic resource.

Note: Sorted by number of citations (from highest to lowest)

## **5. Analysis and Interpretation of the findings**

The EU Commission and its environmental agencies have been instrumental in raising awareness on circular economy models among European citizens, business and industry stakeholders (Leipold & Petit-Boix, 2018; Veleva & Bodkin, 2018; Ghisellini et al., 2018; Smol et al., 2015). This research evaluated the Commission's future-oriented agenda that is intended to foster cleaner and more competitive supply chains for European businesses. Moreover, it presented a systematic review of relevant theoretical underpinnings and empirical studies on the circular economy in the EU context. In a nutshell, it shed light on the value chains of different products and resources, including batteries and vehicles, electronics/electrical products and components, packaging, food, water and nutrients, textiles, construction and building materials and plastics, among others (Stål, & Jansson, 2017).

The EU (2020b) plan is encouraging the businesses as well as their consumers to engage in sustainable production and consumption behaviors and to use and reuse products, materials and resources. This way they will minimize their impact on the natural environment by reducing their waste and emissions (Tisserant et al., 2017; Jiménez-Rivero et al., 2016). The transition towards the circular economy can be facilitated if the EU member countries and their respective governments would create a favorable climate for stakeholder engagement (Camilleri, 2019b; Salem et al., 2018; Milios, 2018; Lazarevic & Valve, 2017; Yau, 2012). They can provide technical assistance, mobilize financial resources and facilitate positive impact investing in circular economy systems (Camilleri, 2020a; Porter & Kramer, 2019; Patricio et al., 2018). For instance, the European Green Deal Investment Plan (EIP) is currently supporting the sectors relating to the



provision of sustainable energy, energy efficiency, sustainable cities and sustainable agricultural practices, among other areas (EU, 2020b).

Various academic articles posited that the practitioners will only be intrigued to engage in the circular economy if it adds value to them, in terms of the economic return on investment, process improvements and product benefits (Camilleri, 2020b; Porter and Kramer, 2011; 2019). The business case will motivate practitioners, creditors and investors to shift from unsustainable and irresponsible practices to the circular economy's sustainable production and consumption behaviors (Kacprzak et al., 2017; Bocken et al., 2016, 2019; Smol et al., 2015). The practitioners are perceiving that there are economic and environmental benefits if they adopt cleaner production systems and sustainable supply chains (EU, 2020a, EU, 2020b; Korhonen, Honkasalo, Seppälä, 2018; Ghisellini et al., 2015). Notwithstanding, there are various businesses and non-profit organizations that are actively engaged in repairing, refurbishing, restoring and/or recycling materials (Haas et al., 2015; Ferronato et al., 2019; Gregson et al., 2015).

On the other hand, this paper identified some of the possible challenges that could have an effect on the businesses' engagement in the circular economy. (EU, 2020a, 2020b; Salem et al., 2018; Yau, 2012). The advancement toward the circular economic practices may still prove to be difficult and challenging for some industries (Luttenberger, 2020; Kirchherr et al., 2018). For the time being, there are many practitioners that are opting to remain in their status quo as they still rely on linear economy models (Michelini, Moraes, Cunha, Costa & Ometto, 2017; Bocken, de Pauw et al., 2016; Bonciu, 2014; EU2014a; EMF, 2013).

In pragmatic terms, it may not be feasible for businesses in the mining and extraction industries and/or for those that manufacture products and components for textiles, plastics, electrical and

electronic items, among others, to avoid using hazardous substances (as there are no sustainable options for the time being) or to reduce their externalities, including emissions and waste (Camilleri, 2019a; Kirchherr et al., 2017). Some businesses that are still finding it hard to reuse and recycle materials or to dispose of their waste in a sustainable manner. For example, the construction and demolition industry will incur significant costs to sort, clean, repair and reutilize materials like scrapped steel, metals, tiles, cement, glass, et cetera. The smaller business enterprises may not have access to adequate and sufficient financial resources to make green investments (Patricio, Axelsson, Blomé, & Rosado, 2018). They may not perceive the business case for the long term, sustainable investment, or they may not be interested in new technologies that will require them to implement certain behavioral changes (Bocken et al., 2016).

There may be other challenges that could slow down or prevent the industry practitioners' engagement in the circular economic strategies (Kirchherr, Piscicelli, Bour Kostense-Smit, Muller, Huibrechtse-Truijens & Hekkert, 2018). The governments may not introduce hard legislation to trigger the corporations' sustainable production and consumption behaviors as this could impact on the businesses' prospects. For these reasons, businesses may not mitigate their externalities, including their emissions or unwanted waste, as these responsible actions would require changing or upgrading the extant technologies or practices (Luttenberger, 2020; Smol et al., 2017; Jiménez-Rivero, Sathre & García Navarro, 2016). Alternatively, they may face other contingent issues like weak economic incentives; access to finance; shortage of green technologies; and a lack of appropriate performance standards in their workplace environments, among other issues (Quina et al., 2018).

The EU needs to overcome these barriers. To do so, it requires the cooperation of all stakeholders including policy makers (of different member states), industry practitioners, consumers and non-government organizations, among others, to translate its policies into concrete actions.

### **Conclusions and Recommendations**

This review indicated that, in many cases, the European policies and strategies have led to a significant reduction in waste and externalities in different EU contexts (Tisserant et al., 2017; Quina et al., 2017). However, the Commission ought to accelerate the shift toward the circular economy in the light of the significant changes in our natural environment and biospheres. Relevant academic research reported that policy makers can possibly provide the right infrastructures, resources and capabilities in terms of logistics, supply, distribution, training, et cetera, to industry practitioners (Milios, 2018; Smol et al., 2017; Sakai et al., 2011). For instance, they can create clusters that would facilitate the circular economy's closed loop systems (Porter & Kramer, 2019; 2011). The development of clusters may result in less dispersed value chains, economies of scales and scope, as well as improved operational efficiencies in manufacturing and logistics (Moraga et al., 2020; Camilleri, 2019a; Lèbre, Corder & Golev, 2017).

### **Acknowledgements**

I thank the editor and his reviewers for their constructive remarks and suggestions.

## References

- Bell, J., Paula, L., Dodd, T., Németh, S., Nanou, C., Mega, V., & Campos, P. (2018). EU ambition to build the world's leading bioeconomy—Uncertain times demand innovative and sustainable solutions. *New Biotechnology*, 40, 25-30.
- Bocken, N. M., de Pauw, I., Bakker, C. & van der Grinten, B. (2016). Product design and business model strategies for a circular economy. *Journal of Industrial and Production Engineering*, 33(5), 308-320.
- Bocken, N., Strupeit, L., Whalen, K., & Nußholz, J. (2019). A review and evaluation of circular business model innovation tools. *Sustainability*, 11(8), 2210.
- Bonviu, F. (2014). The European economy: from a linear to a circular economy. *Romanian Journal of European. Affairs*, 14, 78.
- Camilleri, M. A. (2015). Environmental, social and governance disclosures in Europe. *Sustainability Accounting, Management and Policy Journal*, 6(2), 224-242.
- Camilleri, M. A. (2018). Theoretical insights on integrated reporting. *Corporate Communications: An International Journal*, 23(4), 567-581.
- Camilleri, M.A. (2019a). The Circular Economy's Closed Loop and Product Service Systems for Sustainable Development: A Review and Appraisal. *Sustainable Development*, 27(3), 530-536.
- Camilleri, M. A. (2019b). Measuring the corporate managers' attitudes towards ISO's social responsibility standard. *Total Quality Management & Business Excellence*, 30(13-14), 1549-1561.
- Camilleri, M. A. (2020a). The market for socially responsible investing: A review of the developments. *Social Responsibility Journal*. In Press. <https://doi.org/10.1108/SRJ-06-2019-0194>
- Camilleri, M. A. (2020b). Strategic corporate social responsibility in tourism and hospitality. *Camilleri, MA, Strategic Corporate Social Responsibility in Tourism and Hospitality. Sustainable Development*, 1-3.
- Earthwatch (2019). Plastic Rivers: Tackling the pollution on our doorsteps <https://earthwatch.org.uk/get-involved/plastic-rivers> (Accessed 13<sup>th</sup> April, 2020).
- EASAC (2020). Packaging plastics in the circular. European Academies Science Advisory Council, Halle Germany. [https://easac.eu/fileadmin/PDF\\_s/reports\\_statements/Plastics/EASAC\\_Plastics\\_complete\\_Web\\_PDF.pdf](https://easac.eu/fileadmin/PDF_s/reports_statements/Plastics/EASAC_Plastics_complete_Web_PDF.pdf) (Accessed 13<sup>th</sup> April 2020).

EEA (2018). Waste prevention in Europe — policies, status and trends in reuse in 2017. European Environment Agency, Luxembourg.

EES (2019). Textiles in Europe's circular economy. <https://www.eea.europa.eu/themes/waste/resource-efficiency/textiles-in-europe-s-circular-economy> (Accessed 13<sup>th</sup> April 2020).

EEA (2020). Improving circular economy practices in the construction sector key to increasing material reuse, high quality recycling. <https://www.eea.europa.eu/highlights/improving-circular-economy-practices-in> (Accessed 13<sup>th</sup> April 2020).

EP (2018). A European Strategy for Plastics in a circular economy. [https://www.europarl.europa.eu/doceo/document/TA-8-2018-0352\\_EN.html](https://www.europarl.europa.eu/doceo/document/TA-8-2018-0352_EN.html) (Accessed 13<sup>th</sup> April 2020).

EMF (2013). Towards the Circular Economy, Ellen MacArthur Foundation Rethinking the Future. [http://www.ellenmacarthurfoundation.org/assets/downloads/publications/TCE\\_Report-2013.pdf](http://www.ellenmacarthurfoundation.org/assets/downloads/publications/TCE_Report-2013.pdf) (Accessed 13<sup>th</sup> April 2020).

EU (1994). European Parliament and Council Directive 94/62/EC of 20 December 1994 on packaging and packaging waste, OJ L 365 31.12.1994, p. 10. <https://eur-lex.europa.eu/legal-content/en/TXT/?uri=CELEX:31994L0062> (Accessed 13<sup>th</sup> April 2020).

EU (2006). Directive 2006/66/EC of the European Parliament and of the Council of 6 September 2006 on batteries and accumulators and waste batteries and accumulators and repealing Directive 91/157/EEC, OJ L 266, 26.9.2006, p. 1. (Accessed 13<sup>th</sup> April 2020).

EU (2008). Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives (Text with EEA relevance) <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32008L0098> (Accessed 13<sup>th</sup> April, 2020).

EU (2014a). Towards a circular economy: A zero waste programme for Europe. *COM (2014), 398*.

EU (2014b). Non-financial reporting. European Commission, Brussel, Belgium. [http://ec.europa.eu/internal\\_market/accounting/non-financial\\_reporting/index\\_en.htm](http://ec.europa.eu/internal_market/accounting/non-financial_reporting/index_en.htm) (accessed 13<sup>th</sup> April 2020).

EU (2015a). Closing the loop - An EU action plan for the Circular Economy, Communication from the Commission to the European Parliament, the Council, The European Economic and Social Committee and the Committee of the Regions. <http://eur-lex.europa.eu/legalcontent/EN/TXT/HTML/?uri=CELEX:52015DC0614&from=EN> (Accessed 13<sup>th</sup> April 2020).

EU (2015b). Towards an EU product policy framework contributing to the circular economy. <https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/1740-Towards-an-EU-Product-Policy-Framework-contributing-to-the-Circular-Economy> (Accessed 13<sup>th</sup> April, 2020).

EU (2017). Council conclusions on eco-innovation: enabling the transition towards a circular Economy. European Council of the European Union. <http://www.consilium.europa.eu/en/press/press-releases/2017/12/18/council-conclusions-oneco-innovation-transition-towards-a-circular-economy/#> (Accessed 13<sup>th</sup> April 2020).

EU (2019a). Farm to Fork strategy for sustainable food. [https://ec.europa.eu/food/farm2fork\\_en](https://ec.europa.eu/food/farm2fork_en) (Accessed 13<sup>th</sup> April, 2020).

EU (2019b). Construction and demolition waste. European Commission, Brussel, Belgium. [https://ec.europa.eu/environment/waste/construction\\_demolition.htm](https://ec.europa.eu/environment/waste/construction_demolition.htm) (accessed 5th March 2020)

EU (2019c). Preparatory study for the Ecodesign Working Plan 2020-2024. [https://ec.europa.eu/growth/content/preparatory-study-ecodesign-working-plan-2020-2024\\_en](https://ec.europa.eu/growth/content/preparatory-study-ecodesign-working-plan-2020-2024_en) (Accessed 31st March 2020).

EU (2019d). The drinking water directive. [https://ec.europa.eu/environment/water/water-drink/legislation\\_en.html](https://ec.europa.eu/environment/water/water-drink/legislation_en.html) (Accessed 31st March 2020).

EU (2019e). A new tool to increase the sustainable use of nutrients across the EU. [https://ec.europa.eu/info/news/new-tool-increase-sustainable-use-nutrients-across-eu-2019-feb-19\\_en](https://ec.europa.eu/info/news/new-tool-increase-sustainable-use-nutrients-across-eu-2019-feb-19_en) (Accessed 31st March 2020).

EU (2019f). EU Directive 2019/904 Of the European Parliament and of the Council of 5 June 2019 on the reduction of the impact of certain plastic products on the environment. <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32019L0904> (Accessed 13<sup>th</sup> April, 2020).

EU (2020a). Commission Staff Working Document. Leading the way to a global circular economy: state of play and outlook. European Commission, Brussel, Belgium. [https://ec.europa.eu/environment/circular-economy/pdf/leading\\_way\\_global\\_circular\\_economy.pdf](https://ec.europa.eu/environment/circular-economy/pdf/leading_way_global_circular_economy.pdf) (Accessed 31st March 2020).

EU (2020b). A new circular economy plan for a cleaner and more competitive Europe. European Commission, Brussels, Belgium. <https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1583933814386&uri=COM:2020:98:FIN> (Accessed 13<sup>th</sup> April 2020).

EU (2020c). Guidance for the Assessment of Material Efficiency: Application to Smartphones. JRC Technical Report. Luxembourg. [https://publications.jrc.ec.europa.eu/repository/bitstream/JRC116106/jrc116106\\_jrc\\_e4c\\_task2\\_smartphones\\_final\\_publication\\_id.pdf](https://publications.jrc.ec.europa.eu/repository/bitstream/JRC116106/jrc116106_jrc_e4c_task2_smartphones_final_publication_id.pdf) (Accessed 13<sup>th</sup> April, 2020).

Ghisellini, P., Cialani, C., & Ulgiati, S. (2016). A review on circular economy: the expected

transition to a balanced interplay of environmental and economic systems. *Journal of Cleaner Production*, 114, 11-32.

Goto, M., & Sueyoshi, T. (2020). Sustainable development and corporate social responsibility in Japanese manufacturing companies. *Sustainable Development*. In Press. DOI: 10.1002/sd.2035

Gregson, N., Crang, M., Fuller, S., & Holmes, H. (2015). Interrogating the circular economy: the moral economy of resource recovery in the EU. *Economy and Society*, 44(2), 218-243.

Haas, W., Krausmann, F., Wiedenhofer, D., & Heinz, M. (2015). How circular is the global economy? An assessment of material flows, waste production, and recycling in the European Union and the world in 2005. *Journal of Industrial Ecology*, 19(5), 765-777.

Hao, Y., Wang, Y., Wu, Q., Sun, S., Wang, W., & Cui, M. 2020. What affects residents' participation in the circular economy for sustainable development? Evidence from China. *Sustainable Development*, In Press. <https://doi.org/10.1002/sd.2074>

Huang, Y., Chen, C., Su, D., & Wu, S. (2020). Comparison of leading-industrialisation and crossing-industrialisation economic growth patterns in the context of sustainable development: Lessons from China and India. *Sustainable Development*. In Press. <https://doi.org/10.1002/sd.2058>

Jiménez-Rivero, A. J., Sathre, R., & Navarro, J. G. (2016). Life cycle energy and material flow implications of gypsum plasterboard recycling in the European Union. *Resources, Conservation and Recycling*, 108, 171-181.

Jiménez-Rivero, A., & García-Navarro, J. (2017). Best practices for the management of end-of-life gypsum in a circular economy. *Journal of Cleaner Production*, 167, 1335-1344.

Kacprzak, M., Neczaj, E., Fijałkowski, K., Grobelak, A., Grosser, A., Worwag, M., ... & Singh, B. R. (2017). Sewage sludge disposal strategies for sustainable development. *Environmental Research*, 156, 39-46.

Kemp, D., & Owen, J. R. (2018). The industrial ethic, corporate refusal and the demise of the social function in mining. *Sustainable Development*, 26(5), 491-500.

Kirchherr, J., Reike, D., & Hekkert, M. (2017). Conceptualizing the circular economy: An analysis of 114 definitions. *Resources, Conservation and Recycling*, 127, 221-232.

Kirchherr, J., Piscicelli, L., Bour, R., Kostense-Smit, E., Muller, J., Huibrechtse-Truijens, A., & Hekkert, M. (2018). Barriers to the circular economy: evidence from the European Union (EU). *Ecological Economics*, 150, 264-272.

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

Kushairi, A., Loh, S. K., Azman, I., Hishamuddin, E., Ong-Abdullah, M., Izuddin, Z. B. M. N., ... & Parveez, G. K. A. (2018). Oil palm economic performance in Malaysia and R&D progress in 2017. *Journal of Oil Palm Research*, 30(2), 163-195.

Lazarevic, D., & Valve, H. (2017). Narrating expectations for the circular economy: Towards a common and contested European transition. *Energy Research & Social Science*, 31, 60-69.

Lèbre, É., Corder, G., & Golev, A. (2017). The role of the mining industry in a circular economy: a framework for resource management at the mine site level. *Journal of Industrial Ecology*, 21(3), 662-672.

Leipold, S., & Petit-Boix, A. (2018). The circular economy and the bio-based sector-Perspectives of European and German stakeholders. *Journal of Cleaner Production*, 201, 1125-1137.

Luttenberger, L. R. (2020). Waste Management Challenges In Transition To Circular Economy–Case Of Croatia. *Journal of Cleaner Production*, 120495.

McDowall, W., Geng, Y., Huang, B., Barteková, E., Bleischwitz, R., Türkeli, S., ... & Doménech, T. (2017). Circular economy policies in China and Europe. *Journal of Industrial Ecology*, 21(3), 651-661.

Michelini, G., Moraes, R. N., Cunha, R. N., Costa, J. M., & Ometto, A. R. (2017). From linear to circular economy: PSS conducting the transition. *Procedia CIRP*, 64(2017), 2-6.

Milios, L. (2018). Advancing to a Circular Economy: three essential ingredients for a comprehensive policy mix. *Sustainability Science*, 13(3), 861-878.

Monea, M. C., Löhr, D. K., Meyer, C., Preyl, V., Xiao, J., Steinmetz, H., ... & Drenkova-Tuhtan, A. (2020). Comparing the leaching behavior of phosphorus, aluminum and iron from post-precipitated tertiary sludge and anaerobically digested sewage sludge aiming at phosphorus recovery. *Journal of Cleaner Production*, 247, 119129.

Moraga, G., Huysveld, S., Mathieux, F., Blengini, G. A., Alaerts, L., Van Acker, K., ... & Dewulf, J. (2019). Circular economy indicators: What do they measure?. *Resources, Conservation and Recycling*, 146, 452-461.

National Geographic (2018). A whopping 91% of plastic isn't recycled. <https://www.nationalgeographic.com/news/2017/07/plastic-produced-recycling-waste-ocean-trash-debris-environment/> (Accessed 13<sup>th</sup> April 2020).

OECD (2019a). *Global Material Resources Outlook to 2060*. <https://www.oecd.org/environment/global-material-resources-outlook-to-2060-9789264307452-en.htm> (Accessed 13<sup>th</sup> April 2020).



- OECD (2019b). Policy approaches to incentivize sustainable plastic design. Environment Working Paper No. 149.  
[https://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=ENV/WKP\(2019\)8&docLanguage=En](https://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=ENV/WKP(2019)8&docLanguage=En) (Accessed 13<sup>th</sup> April 2020).
- Patricio, J., Axelsson, L., Blomé, S., & Rosado, L. (2018). Enabling industrial symbiosis collaborations between SMEs from a regional perspective. *Journal of Cleaner Production*, 202, 1120-1130.
- Porter, M. E., & Kramer, M. (2011). MR (2011): Creating shared value. *Harvard Business Review*, 89(1/2), 62-77.
- Porter, M. E., & Kramer, M. R. (2019). Creating shared value. In *Managing Sustainable Business* (pp. 323-346). Springer, Dordrecht.
- Quina, M. J., Soares, M. A., & Quinta-Ferreira, R. (2017). Applications of industrial eggshell as a valuable anthropogenic resource. *Resources, Conservation and Recycling*, 123, 176-186.
- Quina, M. J., Bontempi, E., Bogush, A., Schlumberger, S., Weibel, G., Braga, R., ... & Lederer, J. (2018). Technologies for the management of MSW incineration ashes from gas cleaning: new perspectives on recovery of secondary raw materials and circular economy. *Science of the Total Environment*, 635, 526-542.
- Ranta, V., Aarikka-Stenroos, L., Ritala, P., & Mäkinen, S. J. (2018). Exploring institutional drivers and barriers of the circular economy: A cross-regional comparison of China, the US, and Europe. *Resources, Conservation and Recycling*, 135, 70-82.
- Rodrigues, M., & Franco, M. (2019). Measuring the urban sustainable development in cities through a Composite Index: The case of Portugal. *Sustainable Development*. In Press.  
<https://doi.org/10.1002/sd.2005>
- RoHS (2002). Directive 2002/95/EC of the European Parliament and of the Council of 27 January 2003 on the restriction of the use of certain hazardous substances in electrical and electronic equipment. <https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32002L0095&from=EN> (Accessed 15<sup>th</sup> March 2020).
- Salem, M. A., Shawtari, F., Shamsudin, M. F., & Hussain, H. B. I. (2018). The consequences of integrating stakeholder engagement in sustainable development (environmental perspectives). *Sustainable Development*, 26(3), 255-268.
- Salvini, G., Dentoni, D., Ligtenberg, A., Herold, M., & Bregt, A. K. (2018). Roles and drivers of agribusiness shaping C limat-e-S mart L andscapes: A review. *Sustainable Development*, 26(6), 533-543.
- Scharff, H. (2014). Landfill reduction experience in The Netherlands. *Waste Management*, 34(11), 2218-2224.

- Smol, M., Kulczycka, J., Henclik, A., Gorazda, K., & Wzorek, Z. (2015). The possible use of sewage sludge ash (SSA) in the construction industry as a way towards a circular economy. *Journal of Cleaner Production*, *95*, 45-54.
- Smol, M., Kulczycka, J., & Avdiushchenko, A. (2017). Circular economy indicators in relation to eco-innovation in European regions. *Clean Technologies and Environmental Policy*, *19*(3), 669-678.
- Smol, M., Marcinek, P., Duda, J., & Szoldrowska, D. (2020). Importance of Sustainable Mineral Resource Management in Implementing the Circular Economy (CE) Model and the European Green Deal Strategy. *Resources*, *9*(5), 1-21.
- Stål, H. I., & Jansson, J. (2017). Sustainable consumption and value propositions: Exploring product–service system practices among Swedish fashion firms. *Sustainable Development*, *25*(6), 546-558.
- Tam, V. W. Y., & Lu, W. (2016). Construction waste management profiles, practices, and performance: a cross-jurisdictional analysis in four countries. *Sustainability*, *8*(2), 190-206.
- Tisserant, A., Pauliuk, S., Merciai, S., Schmidt, J., Fry, J., Wood, R., & Tukker, A. (2017). Solid waste and the circular economy: a global analysis of waste treatment and waste footprints. *Journal of Industrial Ecology*, *21*(3), 628-640.
- Unay-Gailhard, Ī., & Bojnec, Š. (2019). The impact of green economy measures on rural employment: Green jobs in farms. *Journal of Cleaner Production*, *208*, 541-551.
- UNEP (2018). Single Use Plastic.  
[https://wedocs.unep.org/bitstream/handle/20.500.11822/25496/singleUsePlastic\\_sustainability.pdf](https://wedocs.unep.org/bitstream/handle/20.500.11822/25496/singleUsePlastic_sustainability.pdf) (Accessed 13<sup>th</sup> April 2020).
- UNEP (2019). Global Resources Outlook. Natural Resources for the future we want.  
<https://www.resourcepanel.org/file/1191/download?token=oxkXHwCD> (Accessed 13<sup>th</sup> April 2020).
- UNEP (2020). Stocktaking of initiative on plastic waste.  
<http://www.basel.int/Implementation/Plasticwaste/PlasticWastePartnership/Meetings/PWPWG1/tabid/8305/ctl/Download/mid/23074/Default.aspx?id=9&ObjID=22867> (Accessed 13<sup>th</sup> April 2020).
- Unger, N., Beigl, P., Höggerl, G., & Salhofer, S. (2017). The greenhouse gas benefit of recycling waste electrical and electronic equipment above the legal minimum requirement: An Austrian LCA case study. *Journal of Cleaner Production*, *164*, 1635-1644.

Vandecasteele, I., Mari i Rivero, I., Baranzelli, C., Becker, W., Dreoni, I., Lavalle, C., & Batelaan, O. (2018). The Water Retention Index: Using land use planning to manage water resources in Europe. *Sustainable Development*, 26(2), 122-131.

Veleva, V., & Bodkin, G. (2018). Corporate-entrepreneur collaborations to advance a circular economy. *Journal of Cleaner Production*, 188, 20-37.

Venturelli, A., Caputo, F., Leopizzi, R., & Pizzi, S. (2019). The state of art of corporate social disclosure before the introduction of non-financial reporting directive: A cross country analysis. *Social Responsibility Journal*.15 (4), 409-423.

WEEE (2002). Directive 2002/96/EC of the European Parliament and of the Council of 27 January 2003 on waste electrical and electronic equipment (WEEE) - Joint declaration of the European Parliament, the Council and the Commission relating to Article 9 <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32002L0096> (Accessed 13<sup>th</sup> April 2020).

WEEE (2012). Directive 2012/19/EU of the European Parliament and of the Council of 4 July 2012 on waste electrical and electronic equipment (WEEE) <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32012L0019> (Accessed 13<sup>th</sup> April 2020).

WEF (2019). 5 steps that could end the plastic pollution crisis – and save our ocean <https://www.weforum.org/agenda/2019/03/5-steps-that-could-end-the-plastic-pollution-crisis-and-save-our-oceans-eb7d4caf24/> (Accessed 13<sup>th</sup> April 2020).

Yau, Y. (2012). Stakeholder engagement in waste recycling in a high-rise setting. *Sustainable Development*, 20(2), 115-127.

Zhang, J., Hassan, S. T., & Iqbal, K. (2020). Toward achieving environmental sustainability target in Organization for Economic Cooperation and Development countries: The role of real income, research and development, and transport infrastructure. *Sustainable Development*, 28(1), 83-90.