The Implementation of Circular Economy Practices

in European Multi-National Enterprises: a Review

Tommaso Calzolaria,b, Andrea Genovesea, Andrew Brinta

aSheffield University Management School, Department of Operations Management and Decision Sciences,

The University of Sheffield, S10 1FL, Sheffield, UK,

t.calzolari@sheffield.ac.uk

*bPresenting author*

a.genovese@sheffield.ac.uk

a.brint@sheffield.ac.uk

## Abstract

The recently promoted European Commission Circular Economy Package (2015) and Circular Economy Action Plan (2018) aim at decoupling economic growth from resource consumption by closing the loop of products and material flows. Coherently to a free-market scenario, these directives openly recognise a very important role for existing organisations, which, through bottom-up initiatives, shall drive the transition towards the Circular Economy in supply chains. In the European context, several companies (both SMEs and MNEs) claim to have changed, over the last years, the way they operate, by adopting Circular Economy practices. Such interventions have emphasised product and material reuse and recycle and the use of renewable energy sources throughout supply chains (Genovese et al., 2017). However, the actual extent to which Circular Economy principles are operationalised and the real impact of legislation changes have yet to be investigated (Stewart & Niero, 2018), especially when dealing with large Multi-National Enterprises, which have been operating, for decades, according to a very traditional linear model. As such, this study aims at assessing the Circular Economy state-of-the-practice in a structured way, by classifying all the initiatives that can be recognised in the largest European companies by revenues, according to the Global Fortune 500 list (fiscal year 2018). Key findings of the underlying research include an evaluation of the type of practices and of their degree of implementation, of the metrics employed to measure their impacts, along with the level of involvement of supply chain partners in such practices.

*Keywords:* Circular Economy, Fortune 500, Sustainability, MNEs, Supply Chain Integration

1. **Introduction and Background**

The increasing interest of policy-makers in promoting sustainable production and consumption systems has already been translated in some directives promoted by the European Union; notable examples include the Circular Economy Package (European Commission, 2015) and the Circular Economy Action Plan (European Commission, 2018). Closing the loop of products and material flows is considered a key strategy in many industries, with the aim of decoupling growth from resource consumption.

The mentioned European directives, coherently to a free-market scenario, openly recognise a very important role for industrial organisations which, through bottom-up initiatives, shall drive the transition towards the Circular Economy (in the following, also CE) in supply chains. Within this context, several companies (both SMEs and MNEs) have claimed to have introduced deep changes in the way they operate, by adopting Circular Economy practices. Such interventions have emphasised product and material reuse and recycle and increased the level of re-generativity of their production and consumption systems, also integrating the use of renewable energy sources throughout supply chains (Genovese et al., 2017).

However, the actual extent to which Circular Economy principles are operationalised has still to be verified and the real impact of legislation changes on companies has yet to be investigated (Stewart and Niero, 2018), especially when dealing with large and well-established Multi-National Enterprises, which have been operating, for decades, according to a very traditional linear model. This lack of a clear review of the state-of-the-practice outlines the necessity to survey real-world applications in existing organisations. This need is also more pressing considering that the development of the Circular Economy concept and its practical applications, at least in the European Union countries, has been at the moment mainly led by practitioners rather than by the scientific community; as such, this has led to a very fragmented body of knowledge, which is lacking a holistic and systematic approach to the topic (Korhonen et al., 2018).

This study aims at assessing the extent to which organisations are implementing Circular Economy practices in a structured way, classifying all the initiatives that can be retrieved in the largest European companies. It has to be mentioned that some similar attempts have already taken place. Among these initiatives, two notable examples are provided by the Circular Economy Industry Platform[[1]](#footnote-1) and Circle Economy’s Circle Lab[[2]](#footnote-2); such initiatives are aimed at gathering and classifying existing Circular Economy applications, strategies and challenges regarding many sectors and geographical contexts. However, these databases are designed as learning platforms, with the objective of sharing existing experiences and best practices, rather than being systematic studies of the actual level of transition to the Circular Economy.

For this reason, this study will focus on a globally recognised set of companies, the Global Fortune 500 list[[3]](#footnote-3), and more specifically on secondary data retrieved from Corporate Sustainability (CS) reports that are released on a yearly basis by major organisations. By using a structured research method, the aim will be to outline how the largest European companies (in terms of turnover) are integrating Circular Economy principles and adopting associated practices.

Also, the study is finally a first attempt to highlight the relationship among Supply Chain Integration (in the following, also SCI) and the adoption of CE practices. Both the academic and the business communities recognise supply chains as the key unit of action, where CE can be implemented (MacArthur, 2013; Aminoff & Kettunen, 2016; Batista et al., 2018; Govindan & Hasanagic, 2018). Indeed, a single company cannot introduce circular interventions without having other actors in its supply chain that are ready to establish more collaborative practices and willing to create self-sustaining regenerative and restorative cycles, with a closed loop perspective. This might suggest that higher levels of collaboration with suppliers and customers could be beneficial to the activation of reduce, reuse, and recycle feedback loops.

On the basis of the identified gaps, the research questions which will be addressed in this study can be summarised as follows:

* RQ1: *To what extent do large European MNEs introduce CE principles in their CS reports? Has the degree of implementation of CE practices increased in the last three years?*
* RQ2: *What are the most common CE practices which are implemented by such companies?*
* RQ3: *Do higher levels of SCI correspond to a higher propensity to implement CE practices?*

In particular, it will be assessed whether general statements contained in annual reports are followed by the implementation of real CE practices, also identifying the most common ones. An important characteristic of the study is the definition of a period of observation of three years, as an initial attempt to analyse the issue considering also a longitudinal dimension, in order to highlight existing trends inside organisations or sectors.

The remainder of this document is arranged as follows. The next section illustrates the method which will be utilised to tackle the research questions. In Section 3, we illustrate the results of the analysis; finally, we summarise the contribution provided by the study, also highlighting the potential theoretical lenses which could be employed in order to make sense of the results, along with some avenues for future research.

## Methodology

The set of European companies which will be employed for this study will be defined on the basis of the Global Fortune 500 list (2019 edition). Such a list collects the Top-500 international corporations in terms of turnover generated during the 2018 financial year. Corporate Sustainability (CS) reports from these companies will be surveyed.

It must be mentioned that an increasing number of (mainly large) companies release CS reports on a yearly basis; the main aim of such reports is to provide internal and external stakeholders with a description of their sustainability strategies and practices (Siew, 2015; Landrum and Ohsowski, 2018); as such, these reports can be seen as the most direct statement concerning sustainability practices adopted by a firm. For this reason, an increasing number of scholars involved in sustainability studies has performed systematic analyses of CS reports. Comas Martí and Seifert (2013) provided a seminal contribution in the use of this approach, by developing a content analysis of CS reports for a cross‐sectoral company sample. Similarly, Meckenstock et al. (2016) investigated the operational translation of sustainability into industrial practices in 12 different industries. Stewart and Niero (2018) performed an analysis of the FMCG industry regarding the implementation of CE practices. The wide availability of CS reports provides then an ideal platform for evaluating the adoption (or, at least, the effort in this direction) of general sustainability practices (and, more specifically, CE ones) by organisations. To date, no study has adopted such approach to evaluate the adoption of CE practices in the largest industrial organisations, across different sectors, in Europe.

In order to address the three research questions, data found in the sourced CS reports will be coded and analysed using a content and a mapping analysis approach, on the model of mentioned study conducted by Stewart & Niero (2018), which is focused on the FMCG sector. To integrate data found in the CS report, secondary sources will be considered as well, including press releases, firms’ websites, newspapers articles, along with reports and white papers from consulting companies. Also, this will contribute to address RQ2 and retrieve more precise information on the CE practices. More specific information about the retrieval process of these documents is given in the following sub-paragraph.

Furthermore, a longitudinal approach will be adopted for all the 50 companies of the subset, in order to highlight the evolution of the adoption of Circular Economy practices; as such, CS reports from the 2016, 2017 and 2018 financial years will be surveyed.

The review will consist of three main phases: (i) sample definition, (ii) data extraction and (iii) data analysis (see Figure 1). The following sub-paragraphs describe these steps in detail.

*2.1. Sample Definition*

The sample has been defined utilising the Global Fortune 500 list (2019 edition), which collects the Top-500 international corporations in terms of turnover generated during the 2018 year. As the study is part of the EU-funded Horizon 2020 Innovative Training Network ReTraCE , it has been focused on companies within this geographical region, more specifically on the Top-50 companies in the list from the European Economic Area (EEA). As such, the sample includes a set of companies belonging to different industries and regions in the EEA.

The online database Corporate Register has been used to collect the CS Reports referred to the 2016, 2017 and 2018 financial years for all the companies of the subset. In order to access further information which could not be found in such reports, available secondary sources have been considered as well, in the form of press releases, firms’ websites, newspapers and magazine articles, white papers from consulting companies and specialized magazines. These sources were accounted for and selected according to their relevance and include the most important international business news sources (such as *The Economist* and *The Financial Times*), and publications from top consulting firms (such as *McKinsey*, *Accenture*, *Boston Consulting Group*). These sources were retrieved using Google News and using pre-determined keywords, such as the following search string: “*Circular Economy*” AND “*Company Name*”. Documents have been reviewed regardless of language (even if the vast majority of the reports where in English, with a few notable exceptions in French).

*2.2. Data Extraction*

During this phase, the collected reports are analysed one by one, and the relevant information is extracted in an Excel spreadsheet and then organised using the NVivo software package. It is important to remark that, differently from Steward and Niero (2019) analysis, pre-defined keywords were not employed. A more inductive approach was employed, as it was recognised that organisations might refer to the same CE practice using different terminologies. As such, besides the specific denominations (which could also depend on industries and geographical contexts), this study is an attempt to identify homogenous practices that could be associated to reduce, reuse, recycle and recover actions, independently if they are classified as CE practices or as sustainability ones in the original reports.

The phase can be divided in 3 sub-phases. The *First wave of coding* involved the identification of the body of text which was relevant for the study in the reports. This has been done by reading each report in its entireness, storing collected string of texts to be further analysed and classified. The type of data extracted did not stop at simply the presence or not of specific keywords of information in a given report (yes/no), but dealt with the collection of all the relevant extracts from the reports, especially the ones related to CE practices and to SCI measures.

During the *second wave of coding*, all the collected extracts have been read, evaluated and the information has been further classified in more specific sub-categories. The categories were predefined, such as the type of practice according to the Waste Hierarchy Framework (European Commission, 2014) or the type of SCI activity according to the research database International Manufacturing Strategy Survey (IMSS 2019). A complete overview of all the categories can be found in Appendix A. In this new classification phase, category values (for example the different types of “*reduce*” practices) have been identified through an iterative process, starting from a critical reading of the collected text. This synthesis effort has allowed to increase the level of homogeneity and comparability between the companies of the sample. In this second wave of coding, extracted data have also been integrated with further secondary data. In order to supplement information coming from reports, we also used data coming from secondary sources to integrate further dimensions into the database, the impact on performance (if reported), the presence of government incentives in the given geographical context, the industry of implementation, the type of ownership of the firm, the main drivers of the adoption, the expected results, the type of relationships in the supply chain and the type of ownership. To date such extraction process has been completed for the Top-50 companies from the list.

In order to perform a final check, the relevant parts of the extracts, both general and specific keywords have been selected: the former including Circular Economy, Circular Supply Chain, Closed-Loop Supply Chain, Waste; the latter more specifically related to Circular Economy practices or to SCI measures which are commonly applied by organisations, such as, for instance, reduce, reuse, recycle, recover, remanufacturing, redesign, design for longevity or supplier integration and customer integration. Such a procedure is aimed at achieving the maximum level of replicability and systematicity of the analysis.



Figure 1. Method flowchart

*2.3 Data Analysis*

The final step includes a critical analysis of the database, aiming at summarising the relevant findings and highlighting the key messages, for addressing the mentioned research questions. This phase will also involve a synthetic representation of the quantitative and qualitative data collected.

The final objective will be to recognise existing trends to address Circular Economy principles in stakeholder communication, but also related to the actual implementation of practices. The most commonly adopted types of practice will be identified, in order to understand which are the dominant implementation approaches and the main drivers for the adoption. Data will be organised through classification dimensions such as the ones reported in Appendix A.

## Results

The current sample is reported in Table 1 below. Tables 2 and 3 report a classification of the sample by country and industry; it is possible to understand that the sample which has been analysed so far is dominated by companies which are incorporated in France (14) and Germany (12); in terms of industries, Services (21) and Manufacturing (13) are the most represented ones. The first includes financial institutions like banks and insurance companies, the second accounts for automotive companies (6) Aerospace, Chemical, Pharmaceutical and FMCG sectors. The Energy (9) industry involves both producers and distributors and the food industry (7) both food and drug stores and food producers. All the companies can be classified as private sector organisations; notable cases which include some form of state participation are Enel (23% of its shares are owned by the Italian government) and Volkswagen (11% of its shares are owned by the Lower Saxony regional government in Germany).

|  |
| --- |
| **The sample** |
| 1. Royal Dutch Shell | 14. Carrefour | 26. Airbus Group | 39. Unilever |
| 2. Volkswagen AG | 15. Bosch Group | 27. Peugeot | 40. Auchan Holding |
| 3. BP plc | 16. Banco Santander | 28. BASF  | 41. Vodafone |
| 4. Daimler | 17. Deutsche Telekom | 29. Royal Ahold Delhaize | 42. Telefonica |
| 5. EXOR Group (FCA) | 18. Credit Agricole | 30. Deutsche Post DHL Group | 43. Anheuser-Busch InBev |
| 6. AXA | 19. Enel | 31. Munich Re Group | 44. ING Group |
| 7. Total | 20. Uniper | 32. Societe Generale | 45. Legal & General Group |
| 8. Allianz | 21. ENI | 33. ArcelorMittal | 46. Louis Dreyfus |
| 9. BNP Paribas | 22. HSBC Holdings | 34. Renault  | 47. Lloyds Banking Group |
| 10. Prudential | 23. Electricite de France | 35. Aegon  | 48. Bayer  |
| 11. BMW Group | 24. Tesco | 36. Aviva  | 49. Finatis  |
| 12. Assicurazioni Generali | 25. Engie | 37. Equinor  | 50. CNP Assurances |
| 13. Siemens | 38. BPCE  |

Table 1: The current sample

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| --- | --- | --- | --- | --- | --- |
| **Country** | **Companies** |  |  |  |  |
| France | 14 |  |  |  |  |
| Germany | 12 |  |  | **Sector** | **Companies** |
| UK | 9 |  |  | Financial Services | 21 |
| The Netherlands | 6 |  |  | Manufacturing | 13 |
| Italy | 4 |  |  | Energy | 9 |
| Spain | 2 |  |  | Food | 7 |
| Table 2: The sample by country |  |  | Table 3: The sample by industry |

The majority of the companies (37) published the sustainability performance in a dedicated Sustainability report, as summarised in Table 4, while the remaining included the results in their Annual Report. A further aspect that has been tested is the adherence of the 2018 reports to the most commonly used standard for sustainability reporting, the Global Reporting Initiative (GRI) framework[[4]](#footnote-4). This approach is thought to help businesses to understand and communicate their sustainability results, structuring them in similar way to financial result. GRI reporting standards seem to widely accepted, as more than half of the organisations (27) are compliant with its guidelines in their 2018 reporting and 8 make a clear reference to the GRI structure, while lacking only a GRI index. The remaining 15 organisations do not mention or use the GRI. The detail can be observed in Table 5.

|  |  |
| --- | --- |
| **Type of Reporting** | **No of Organisations** |
| **Dedicated Sustainability Report**  | 37 |
| **Sustainability Information in the Annual Report** | 13 |

Table 4: The Type of Report analysed

|  |  |
| --- | --- |
| **Reporting Standards** | **No of Organisations** |
| **Compliance to GRI (Standards or GRI- G4)** | 27 |
| **Non GRI - Only citing GRI** | 8 |
| **Non GRI**  | 15 |

Table 5: Compliance of Reports to GRI Standard

Figure 2 shows the interest that is devoted to Circular Economy in the CS reports.

Firstly, it has been measured the occurrence of the keywords combination “*Circular Economy*” in Corporate Sustainability reports. It can be observed that the sample of firms under investigation exhibits a growing interest towards CE, with a peak in 2018, when the 50% of the firms under investigation does mention the words “Circular Economy” at least once in their Sustainability reports. It can be seen such interest towards the CE concept is a recent one (as in 2015 just 3 out of 20 companies where citing it). This can be interpreted as a direct consequence of the promulgation of the mentioned European directives, and of the emergence of a heated public debate, which has sparkled an increased interest of companies in integrating Circular Economy principles in their operations.

Secondly, it has been checked how many of these 25 companies have a dedicated section in the report about CE. Only 9 organisations include a dedicated section, while all the other 16 do not. This might suggest the lack of a structured approach to report CE practices.



Figure 2. Compliance of Reports to GRI Standard

*3.1 CE Drivers*

One of the main focuses of the study is to determine the dominant approach in terms of implementation strategies, outlining the types of practices which are mostly adopted by large organisations. This will allow to establish whether such practices just implement the basic elements of the Circular Economy paradigm (such as recycling and/or recovering waste streams generated by the current linear production systems), or, instead, involve a deep transformation of products and business models in order to reduce waste streams and resource consumption altogether.

It is also expected that this increased interest and attention to the principles goes along with an increased amount of real-world implementation of Circular Economy practices. What should also be determined are the main drivers for the adoption of Circular Economy practices, recognising whether this is a matter of compliance with policy directives or if they are considered as economically attractive initiatives with the potential of reducing costs and gaining new revenues, bringing an impact on the corporate performance.

In terms of the drivers which favoured the adoption of CE practices, most of the analysed reports mention the economic and the environmental benefits which can be obtained by the implementation of such practices (see Table 6). Most of the companies claim that the implementation of CE practices can help reducing waste and reducing the consumption of virgin resources. Further environmental benefits are provided by the avoided emissions thanks to recovered waste and by the lower consumption of energy requested by production processes that are able to valorise available parts, components and by-products and avoid to start production from virgin raw materials*.* Reference to ecological limits and Paris Agreement are enriching the discussion.

Economic drivers are well quoted as well and they are mainly linked with increasing the amount of value that can be extracted from products by keeping resources in use, and retaining the value of materials after products end of life.

Legal issues, such as the *compliance* to present, or even future, regulations is also a common reason for adoption. It has to be remarked that social drivers are generally overlooked and linked to the more traditional Corporate Social Responsibility agenda.

The only notable example of this is Volkswagen hosted Global Social Business Summit, which involved the social commitment of employees to discuss ideas and initiatives relating to the plastics industry and the circular economy, solidarity and other topics.

*3.2 CE Practices*

Subsequently, employed practices which can be retrieved in the Sustainability Reports have been classified according to two dimensions, namely the type of practice and the level of implementation. As regards as the type of practice, the framework has been derived from the key contributions provided by Kirchherr et al. (2017), Korhonen et al. (2018a) and Potting (2017), which have been integrated and slightly modified for the purpose of the study.

Based on these seminal studies, CE practices could be classified in the following categories. *Reduce* practices prevent resource use, either with redefining product functions, or through rethinking, redesigning or making product use more intensive for example through sharing. Examples of such practices include the *redesign products* and of its *packaging*; the promotion of *modular product design*; the redesign of manufacturing infrastructure; the *promotion of collaborative consumption practices*; the move towards a *performance-based or service-based business model*, rather than one based on simple products.

|  |  |  |
| --- | --- | --- |
| **Driver** | **Companies** | **Examples** |
| Economic | 14 out of 25 | We are looking at how we can advance the circular economy – where resources stay in use for as long as possible, with the maximum value extracted in that time, and are then recovered and regenerated at the end. (**BP**) In 2018 Several innovation hubs are developed to study carbon conversion, with the aim of pursuing carbon capture and conversion and promoting the circular economy. (**Total**) |
| Environmental | 22 out of 25 | FCA leverages the potential to reduce the environmental footprint of our products by embracing the concept of the circular economy. Our design approach addresses the environmental footprint of products throughout their life cycle, and integrates eco compatible materials and design choices that maximize recovery and recycling for end-of-life vehicles. (**FCA**) The level of action needed requires measures to: […] Develop a circular economy that allows natural resources to be recovered, and to regenerate themselves. (**BNP Paribas**) |
| Legal | 3 out of 25 | We also comply with, and monitor changes to, applicable regulations. In regions around the world, various regulations designed to create a more circular economy are in development and we are preparing to meet those requirements when they are introduced. (**Royal Dutch Shell**)In line with the Circular Economy Roadmap led by the Ministry for Environmental and Sustainable Transition (Ministère de la transition écologique et solidaire), Carrefour supports the creation of a National Pact for plastics gathering government, civil society and all voluntary industrial and retail companies. (**Carrefour**) |
| Social | 2 out of 25 | Volkswagen and the Autostadt contributed to the Global Social Business Summit not only as a partner and host, but also with a large team of socially committed employees. During workshops, keynotes, master class events, networking sessions and presentations, participants and interest groups met for talks. They discussed ideas and initiatives relating to the plastics industry and the circular economy, solidarity, mobility, sport and nutrition. (**Volkswagen AG**) |

Table 6: Examples of CE Drivers

The category *Renewable Energy & Resource Efficiency* have been classified in a specific class of interventions. These practices includes the incremental improvement of the efficiency in manufacturing systems, or the adoption of renewables as a source of energy. These types of practice are quite commonly mentioned in CS Reports and distinguishing them from the other categories of practices could be helpful in recognising, to a broader extent, the strength and the weaknesses of the current implementation approaches.

*Reuse practices* included repairing, preventive maintenance and refurbishing actions and generally aim at reutilising products (or components) for their original function.

*Recycling interventions* aimed at recycling and reprocessing materials from parts or products. Also the remanufacturingof parts and components was considered as part of this category. Common practices are: *by-products reutilisation*, recycling of parts, components and materials; *utilisation of recycled materials*; packaging recycling, investments in recycling infrastructure. *Recover practices* involved energy recovery from by-products or waste, either directly or through the production of alternative fuels like biofuels.

The level of implementation of each practice, in each firm, has been also evaluated. In particular, 5 incremental implementation stages have been considered, on the basis of an objective evaluation of the level of adoption of that specific practice. This choice has been inspired by other similar studies (Ancarani et al., 2019a) that evaluated Internet of Things (IoT) projects of a sample of organisations on the basis of their readiness level.

Such scoring process is reported here: *No mention of CE practices* (N) indicates the absence of any practice that can be associated to the Circular Economy. *Exploratory and conceptual* (C) describes the presence of CE practices that are just mentioned as an aspiration, when the concept is mentioned symbolically with no clear link with an operational implementation. *Testing* (T) refers to R&D activities, which are being conducted on the implementation of CE practices. It is the case of pilot projects in specific plants, offices, around the world. We considered as being part of this level of implementation also the strategic acquisitions of start-up companies. If some evidence of CE practices adoptions could be identified in some product/service lines, it has been described as *Early Implementation* (EI). In this case, small impacts are reported, along with some plans for future extensions. The maximum level of implementation is represented by *Company-wide implementation* (CI). This happens when the practice is part of company culture and widely implemented in different geographical areas and a clear evaluation of the overall impact is provided.

The following Table 7 reports all the four industries and the main CE practices being adopted by companies belonging to such industries.

Such practices are also characterised by their level of implementation. This simplification could be undertaken because of the high level of similarity in the type of practices and in their level of implementation within the same industry. Practices which are reported in the table are present in at least half of the sample of companies from the considered industry.

In general, it can be seen that practices linked to *Resource Efficiency and Renewable Energy*, *Reduction* and *Recycling* are the most popular, while developments linked to product reuse are currently overlooked.

In the manufacturing industry (including players from automotive and related industries), identified Circular Economy practices are related to the possibility of closing the loop of some valuable components and of key materials which can be reused and recycled after the end of the product life. Such materials include aluminium, steel, plastics and batteries electrolytes and graphite. These initiatives have been pushed by the stringent legal requirements promoted by the EU (especially through the Directive 2000/53/EC), which set clear and quantifiable targets for reuse, recycling and recovery of End-of-Life-Vehicles and their components. In this context, design practices are playing an important role to operationalise a closed loop supply chain and reduce resource consumption.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|   | **Manufacturing** | **Energy** | **Financial & Services** | **Food** |
| **Reduce – Prevention** | (CI) Design for resource recovery(T) Modular Design(T) Promoting collaborative consumption(EI) Product as a Service | (EI) Redesign packaging | (CI) Disinvesting from coal energy sources(CI) Investments in sustainable solutions(CI) Design of "green" products | (CI) Dynamic product pricing to reduce waste(CI) Prioritise regenerative & less impactful resources(EI) Refuse packaging |
| **Renewable Energy & Resource Efficiency** | (CI) On-site generation of Renewable Energy(CI) Energy sourcing from Renewable Energy(CI) Improve production systems efficiency | (CI) Investments in large-scale Renewable Energy generation plants(CI) Improve Energy Efficiency | (CI) Investments in Renewable Energy companies(CI) Energy sourcing from Renewable Energy(CI) Promoting Resource Efficiency of businesses and households |  |
| **Reuse** | (EI) Reuse of parts and components (batteries) | N/A | N/A | (CI) Reuse of packaging  |
| **Recycle** | (CI) Closing the loop for some products/materials | (CI) Investments in recycling technologies | (EI) Materials recycling (paper) | (CI) Recycled materials utilisation |
| **Recover** | N/A | (CI) Energy Recovery from by-products  | N/A |  |

Table 7: CE practices in selected industries and their level of implementation (in parenthesis)

However, as it can be seen from Table 7, most of the identified practices are still generally in a testing (T) and early implementation (EI) stage. Volkswagen and BMW, as founders of the Aluminium Stewardship Initiative (ASI) are defining the standard for a transparent and sustainable supply chain. As part of the Global Battery Alliance, Daimler, Volkswagen (and also Enel), are investing more than €1 billion ensuring not only the longest possible service life, but also the use of materials from a closed-loop point of view. BMW and FCA have both activated other development projects to increase the recycling rate of batteries, to investigate how they can recycle electrolytes and graphite into secondary material that could be suitable to be used in other batteries.

FCA is focusing on projects for the use of recyclable, re-shapable and repairable, bio-based fibre-reinforced epoxy composites, while Daimler is increasingly using renewable raw materials and recycled materials in seat covers made of one hundred percent recycled PET bottles, similarly to Bosch, which is employing recycled plastics as raw material for its power tools. The first remanufacturing projects have resulted in the development of specific product lines of remanufactured parts to support the aftermarket needs of customers (FCA, Volkswagen and Renault).

An increased interest in the mobility as a service concept has been reported in the last years, even if most of the existing projects are still at a Testing or Early Implementation stage. *Mobility-as-a-service* concepts include ride sharing (Volkswagen, FCA), on-demand mobility services of car-sharing in cities (Volkswagen, Daimler, FCA), also with electric vehicles. All these services promote a more collaborative consumption model that results in some benefits as an increased use of the products. Daimler *mobility-as-a-service* model includes 31 million customers in over 120 cities worldwide, from Europe to America and Asia and it is growing, thanks to a portfolio of customers which includes providers such as *Blacklane, Flixbus, Careem, car2go, Moovel and myTaxi*. Some other initiatives have also the objective to promote the concept of Product as a Service. FCA, in 2018, announced a subscription-based car ownership program, where a monthly subscription service is expected to give customers access to FCA portfolio vehicles and the ability to exchange the vehicle for another FCA brand and model.

Looking at the Energy sector, it is interesting to notice that the concept of the Circular Economy is interpreted as closely related to waste management (with specific reference to plastic waste), more than in terms of divestment from fossil fuels and transition towards a renewable energy.

Shell and Total are among the founders of the *Alliance to End Plastic Waste*, committing themselves to invest more than $1 billion, and with the goal of investing $1.5 billion over 5 years to develop solutions in this field. At the same time, this problem is being dealt with through acquisitions of technological start-ups; Total, for instance, acquired the French company Synova, a leader in manufacturing of high-performance recycled polypropylene.

Some recovery practices are also present. For example, BP has recently acquired Neste, a leading producer of renewable energy products, to explore opportunities to increase the supply of sustainable fuel for aviation (the company has already worked as a supplier for Bombardier and Airbus).

Another major industry player, Enel, is a founding member of the Italian Circular Economy Stakeholder Platform (ICESP). During 2018, Enel was involved in international panels on the circular economy (including WBCSD - Factor10; Ellen MacArthur Foundation CE100).

This first assessment, however, seems to confirm that firms from this industry are not implementing the full spectrum of CE practices. This is understandable, as most of these companies operate in the extractive industry, which is still fossil fuel-dominated. As such, currently, the Circular Economy is viewed by these companies as a *tool* to perform some remedial actions which could mitigate the negative externalities of their core business.

Similarly, not a great involvement can be witnessed in companies belonging to the financial sector, which demonstrate a general lack of clarity when dealing with CE and with the potential role which banks and insurance companies could have in supporting the transition towards an economy of services more than products. Surprisingly, only 6 financial institutions (over 21 of the sample) identify in their CS reports the huge business opportunities which could arise.

Some banks are pioneering the offer of financial instruments to finance the transition of companies, both for industrial players and for consumers. BNP Paribas (part of the EMF CE100 Network[[5]](#footnote-5)) has committed to support the implementation of CE practices through a dedicated fund aimed at targeting CE players (particularly innovative start-ups). In particular, they are offering solutions aimed at funding the lease, rather than the ownership, of industrial equipment, and implemented several projects for extending assets life-cycles. Banco Santander and Credit Agricole are concentrating their efforts on shifting the automotive sector towards a low-carbon economy through services such as vehicle leasing and renting, to promote the use of hybrid or electric cars in the countries where they operate. Deutsche Telekom reports of the successful growth of leasing model usage for devices like routers and media receiver. These devices are refurbished for reuse entailing better results in terms of recycling rate and duration of use. Other virtuous examples are represented by insurance for mobility-as-a-service solutions. For instance, both Allianz and AXA provide services supporting the needs of *Blablacar* carpooling members.

Other most common practices among the other companies from the financial sector include the divestment from carbon fossil fuels and the investment in sustainable solutions (mainly renewable energy for both households and firms). Another popular practice involves the design of “green products”, most of the times related to emerging consumers’ solutions. Most notable examples include insurances for electric vehicles (cars and bicycles), for domestic renewable energy generation systems.

*3.3 A Preliminary Classification of CE Practices Adoption*

Based on the above mentioned classification, each one of the 50 companies of the considered sample has been assigned a score from 0 to 4 on the basis of the level of implementation of each type of practice. The result of such simple scoring process is reported in Table 8 in order to get an overview of the level of implementation of the considered companies; the detailed evaluation is available on request and will be part of the supplementary data section of the final version of the study.

At the top of the table there are companies with the most evolved implementation strategy of the CE. They belong to each of the sectors represented. Carrefour is one of the company which exhibits a very high level of implementation, applying at least one practice of each type at high levels of implementation; Table 9 shows the detailed of the implemented practices in this company, and its score.



Table 8: An evaluation of the CE score

|  |  |
| --- | --- |
| **Reduce** | (EI) Refusing the use of plastics and the sale of plastic straws by the end of 2018 removing single use plastic straws from juice boxes(CI) Rethinking prices to reduce food waste, selling products with short use-by dates at low prices: (CI) Collaborating with local associations donating everything that can be given away: unsold stock is donated set up to tackle poverty. |
| **Reuse** | (T) Promoting the reuse of packaging ambitiously aiming at 100% reusable, recyclable or compostable packaging; |
| **Recycle** | (CI) Incorporating 50% of recycled plastic in its juice, soda and water bottles. |
| **Recover** | (CI) Energy production from bio-methane - product wastage that can no longer be consumed (withered flowers, spoilt fruit and vegetables, etc.) is converted into biogas, and then into bio-methane.  |
| **Renewable Energy & Resource Efficiency** | (CI) Utilisation of renewable energy such as geothermal power, wind power, solar power, etc. Heat generated by stores also has to be recovered and reused – such as the heat generated by refrigeration units. |
| **CE score** | 18 |

Table 9: CE practices at Carrefour

*3.4 Supply Chain Integration Activities*

Similarly to the retrieval process for CE practices, in order to measure the level of SCI, relevant code has been extracted from the reports. These data has been classified according to established dimensions used in SCI research (Frohlich and Westbrook, 2001; Wiengarten et al., 2014). The dimensions to assess the level of SCI has been derived by the previously validated research database International Manufacturing Strategy Survey (IMSS). This globally recognised research project has been extensively used in SCI studies and it identifies the following SCI activities:

* Sharing information with key suppliers/customers (about sales forecast, production plans, order tracking and tracing, delivery status, stock level);
* Developing collaborative approaches with key suppliers/customers (e.g. supplier development, risk/ revenue sharing, long-term agreements);
* Joint decision-making with key suppliers/customers (about product design/modifications, process design/ modifications, quality improvement and cost control);
* System coupling with key suppliers/customers (e.g. vendor-managed inventory, just-in-time, Kanban, continuous replenishment).

The most common example among the reported measures is the creation of stable and long-term relationships with key suppliers, which sometimes are also involved in activities, such as the design products and services. Moreover, organisations often engage in programs with suppliers helping them develop themselves from different points of view: compliance with environmental and human rights standards. To decrease its overall environmental impact Vodafone is committed in SC financing projects, helping suppliers to reduce their environmental impact and invest in renewable energy projects.

The link between supply chain integration and Circular Economy is highlighted in some of the reports. The Spanish telecommunication provider Telefonica, for example states that its suppliers are “essential allies in the transition towards CE”. Their common objective focus on resources consumption optimisation and stimulating the return of materials to the productive cycle. Table 10 shows examples of SCI activities in companies’ reports.

Based on this classification, each one of the 50 companies of the considered sample has been assigned a score from 0 to 8 on the basis of the presence of traces in the report of these practices. Scores are given by counting the number of practice mentioned. On the basis of the so defined SCI score, three classes has been defined, representing increasing level of supply chain integration. High integrated organisations are the ones with a SCI score ≥ 5. Medium integrated ones, have SCI score between 2 and 4, and low integrated if the score is ≤ 1. Table 11 shows how these three classes of organisations are performing in terms of two scores that are related to the stage of implementation of CE practices. The first score is a measure of the quantity of the CE practices adopted, obtained simply counting how many practices the organisation has included in its CS report; the second score represents an indication of the level of implementation of the practices adopted, and coincides with the CE score previously defined. The two variables seem to have a relationship. Organisations that have a higher SCI score tend to adopt a higher number of CE practices and generally at a higher level of implementation.

|  |  |
| --- | --- |
| **SCI activity** | **Examples** |
| Sharing information  | “We minimize food waste in own operations by preventing it, through optimized store replenishment and on-shelf management, and by re-directing unsold food to feed people.” (**Royal Ahold Delhaize**) |
| Developing collaborative approaches  | “We work tirelessly with our suppliers to ensure that our quality standards are met. We run a bespoke due diligence audit programme that offers documented evidence of compliance to our standards and monitors continual improvement.” (**Tesco**) |
| Joint decision-making with key suppliers/customers  | “Another aspect of supplier engagement focuses on fostering innovation to improve products, processes and content, often leading to sustainable solutions such as the use of recycled raw materials or weigh reduction” (**FCA**) |
| System coupling with key suppliers/customers  | As the Company performs a strong platform prime integratorrole, managing the supplier base to enable the delivery of ontime and on quality product to the final customer. […] The Company’s suppliers provide a large proportion of the value in our products, necessitating a robust supply-chain governance framework. This is supported by processes and tools that foster partnership, risk mitigation and supplier performance development. (**Airbus**) |

Table 10: Examples of SCI activities

|  |  |  |
| --- | --- | --- |
| **SCI class** | **Average number of CE practices** | **Average CE score** |
| High integration (SCI score ≥5) | 9 | 14.3 |
| Medium integration (2≤SCI score<5 ) | 6 | 13.1 |
| Low integration (SCI score<2) | 4.2 | 9.3 |

Table 11: The relation between SCI level and CE practices adoption

*3.4 KPIs*

In CS reports, each company mentions some measures which are employed in order to keep track of the success of the implementation of the cited practices. Most of the indicators which are employed do not differ from those ones which can be found in the sustainable supply chain management literature, with no specific emphasis on circularity issues (see Table 12). It must be mentioned that most of the KPIs which are employed are *efficiency* indicators, comparing a measure of polluting activities (for instance, carbon emissions) to the total production output. It must be highlighted that the usage of such indicators for measuring the success of Circular Economy practices is problematic, as figures could be manipulated to obtain better results just increasing the production output (for instance, by productivity improvements), rather than by implementing practices which can promote a better usage of resources. Furthermore, most of the times the chosen indicators do not distinguish the contributions of the single practices, accounting for a general approximation.

Just one company, the Italian Energy Utility provider Enel, develops a measurement system to assess the level of circularity of its solutions and products. Enel X Circular Economy Score is calculated as a value in a scale 0-100, by combining *five key dimensions* (commitment by suppliers to CE principles; presence of reusable elements which can increase the life cycle of the product; resource efficiency; reuse of materials; support offered to suppliers) with the evaluation of the presence of *five circular business models* (sustainability of resources, product as a service, sharing platforms, product life cycle extension, recovery and recycling). The result of this evaluation process is the assignment of a circularity score from 0 to 100. The measure is subject to third-party verification and then made available to the end customer.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Emissions** | **Waste** | **Energy** | **Water** | **Circularity** |
| CO2-eqVOCsNOxOzone DepletionParticulate Matter | Waste DisposalWaste Recovered | Energy IntensityRenewable Energy UsageEnergy Usage | WastewaterDischarges to water | CE Score |
|
|
|
|

Table 12: Employed KPIs

## Further Reflections

*4.1 Adoption of CE practices through Institutional Theory and Isomorphism*

The adoption by existing organisations of CE practices can be interpreted as the result of a set of some distinct pressures coming from the wider environment, represented by competitors, suppliers and customers of the supply chain, policy-makers, other supply chains and groups of stakeholders. Referring to Di Maggio and Powell (1983) *institutional theory* and to the concept of *isomorphism* the reasons behind the implementation of such practices can be summarised into three main macro-categories:

* *Coercive isomorphism*. The presence of regulations and legislations can be the main reason for the adoption of some practices. A very powerful example is represented by the French strong legislation on food waste, which effectively bans supermarkets from throwing away or destroying unsold food. This is actually forcing companies to donate surplus food to charitable trusts, food banks, and other types of organisations which provide redistribution services. This stringent requirement obliges the different players in the industry to take measures which act on the root of the problem, in order to reduce systematically waste streams leveraging on multiple strategies. It might not be a case that both Carrefour and Auchan are very well positioned in the CE score table. As already mentioned, Carrefour is not only recycling unavoidable waste (for instance, by converting it into biogas). This company has also taken measures in terms of rethinking product prices to reduce food waste, for instance by selling products with short use-by dates at lower prices and of collaborating with local charity associations, regularly donating everything that can be given away.
* *Normative isomorphism*. In this case, practices are adopted regardless of the presence of an actual legal constraint; however, some external pressures can still be recognised as the main force driving the change. In an industrial context, this is normally traced back to professional, educational or trading standards which are adopted as *norms.* This can also involve consortia of organisations which belong to different supply chains. The already mentioned *Global Battery*, *Aluminium Stewardship* and *Responsible Steel* initiatives are all powerful examples of current norms and standards which are promoting the adoption of CE practices. Another interesting example is represented by the milestone pledged by 5 banks (among which BNP Paribas, ING and Société Générale) to jointly support and create a standard to finance the necessary transition to the low-carbon economy and reach climate goals[[6]](#footnote-6). The common objective of these collaborations comprise the establishment of accepted industry approaches that are able to influence the development of more sustainable practices in the industry.
* *Memetic isomorphism*. Even in the absence of coercive or normative pressures, a company could still adopt CE interventions, for instance by following the example of other players in the same industry or sector. In this category there are also examples in which actors (e.g. suppliers, customers) from the same supply chain or in other production networks indirectly push for the adoption. An example is represented by the initiative, adopted by many financial institutions, related to the divestment from the coal sector. It is possible to notice, indeed, that all the surveyed companies from this sector report such practice, while investing in renewable energy solutions and products.

This study confirms an increasing trend not only in the interest towards CE but also in the adoption of the different types of CE practices that have been reported in their CS Reports. Looking deeper at the dominant implementation approaches, regardless of the sector, some considerations can be highlighted:

* Investments from the manufacturing sector are mainly focused on remanufacturing and recycling practices, which directly contribute to the improvement of the efficiency of operations, and to the reduction of the negative environmental impact, while generating additional revenues and serving specific markets. CS Reports mention that the recovered waste from end of life products through these strategies has a direct impact even in terms of reduced CO2 emissions and energy use. According to the longitudinal perspective which was adopted in the study, a growing number of companies is at least considering the implementation of such practices.
* In general, an ambiguous attitude is reported towards the implementation of practices which deal with rethinking product design, product functions and business models. While some examples are provided, their effective impact on the overall business performance is most of the time not explicitly documented. Furthermore, there is a lack of declared long-term objectives regarding strategic and structural investments in this direction.
* The role of national and international legislation seems to play a quite important role in driving good practices. Based on the positive experience of the French legislation on food waste, further examples should be explored in order to highlight the impact of national laws and EU directives (for instance, the very recent one on single-use plastics) on specific industries and on specific geographical areas.

*4.2 SC integration vs CE practices adoption: A suggested research agenda*

The study represented an introductory analysis to investigate a hypothesised relationship between the level of integration with suppliers and customers and the propensity to adopt CE practices along supply chains. Preliminary results should be interpreted by taking into account the possible limitations of the method. Referring to secondary data and information that were found in reports or online might constitute a challenge. Organisations might not report (on purpose) all the practices, also not to disclose information that could be linked to competitive advantage positions[[7]](#footnote-7). However, we assumed that it is in the interest of the organisations to report virtuous practices that contribute to their overall sustainability performance. Many companies in the sample mention also supply chain integration practices and how they are related to sustainability results. This seems to strengthen the hypothetical relationship among the two constructs (SCI and CE practices adoption).

Further steps could include the validation of these preliminary conclusions. The need to verify such potential causal relationship constitutes an interesting research gap that should be further investigated and proved by more articulated inferential studies. An interesting approach, which makes use of secondary data, is provided by Ancarani et al. (2019b). In the study there is an attempt to explain if there is any causal relationship between reshoring and Industry 4.0 initiatives. The database created for this study could constitute a good starting point to approach the problem with a similar approach.

Another possible contribution could be represented by the expansion of the concept of SCI, considering it within the CE paradigm. Since Frohlich and Westbrook (2001) definition, SCI traditionally focuses on forward supply chain activities, without explicitly considering reverse supply chain ones. This might be due to the historically limited diffusion in real industrial contexts of closed-loop-supply-chain applications and the predominance of networks that collaborate in the context of a linear economy.

## Conclusions

This study has provided a first step in terms of the systematic assessment of CE practices in multi-national enterprises. Considering the top-50 European companies in terms of turnover (as reported by the Fortune 500 list), the study has investigated the adoption of CE practices in such organisations, also investigating adoption drivers and declared impacts. To this aim, sustainability reports of these organisations were systematically reviewed, along with secondary sources.

From the investigation, it can be derived that the attention devoted by the considered organisations to CE practices is generally increasing; also, adoption drivers linked to the environmental and economic opportunities linked to such practices play a major role towards their implementation. Practices linked to Resource Efficiency and Reduction, along with Recycling are the most popular, while developments linked to product reuse are currently overlooked. In general, the adoption of CE practices seems sporadic, and far from conditioning the overall business performance. This is also reflected by the fact that seldom company employ true circularity indicators for keeping track of their performance; in most of the cases, indeed, companies adopt some environmental measures which are designed as *efficiency* metrics, thus highly sensitive to productivity improvements. The considered sample also exhibits a lack of reflections on the social impacts of the implementation of CE practices.

Reported collaborations at a supply chain level are mainly focused on auditing activities, involving some life-cycle evaluation of the overall environmental impact of products and services. More can be done in terms of exploring suppliers’ and partners’ willingness to challenge existing production and consumption models more broadly, and in terms of collaborative adoption of CE solutions. However, the presence of higher levels of integrations in the supply chain, usually reflects in a higher propensity of having more CE practices implemented and at a higher level of implementation.

Future researches will be aimed at: (i) increasing the sample coverage, reviewing reports and other data for the Top-100 European companies in terms of revenues; (ii) establishing causal relationships between SCI activities and CE practices adoption and between adopted CE practices and measured impacts. Further steps of this research might also look at extending the study to a broader set of companies or geographical areas.

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| --- | --- |
| **Organization name** | Company A |
| **Industry** | EnergyPetroleum Refining |
| **Country** | The Netherlands |
| **Report analysed** | Sustainability Report 2018 |
| **Year of the Report** | 2018 |
| **"Circular Economy" occurrences in the report** | 2 |
| **Presence of Reduce practices** | (T) Redesign packaging for resource recovery(CI) Redesign products that provide higher energy efficiency |
| **Renewable Energy & Resource Efficiency practices**  | No |
| **Presence of Reuse practices** | No |
| **Presence of Recycle practices** | (EI) Investments in recycling technologies(T) Recycle materials (plastic) |
| **Presence of Recover practices** | (T) Investing in recovery infrastructure(EI) Energy Recovery from byproducts/waste |
| **Suppliers integration measures** | Yes |
| **Customers integration measures** |  |
| **Main adoption drivers** | Compliance to regulation |
| **Expected results**  | Not explicitly mentioned |
| **Registered Impact on performance** | 400,000 tonnes waste for recycling or reuse |
| **Presence/Absence of government Incentives** | Not mentioned |
| **Presence/Absence of government Regulation** | Presence: A Circular Economy in the Netherlands by 2050 |
| **Type of ownership** | Private |

## Appendix A. Classification dimensions of a CS Report

## Appendix B. CE practices adopted by each organisation, with their level of implementation





## Appendix C. SCI activities reported by each organisation and SCI score

##

## Short Biographies

## Tommaso Calzolari is an Early Stage Researcher and PhD Student at the University of Sheffield, UK. He is an ESR for the EU’s Marie Skłodowska-Curie Innovative Training Networks ReTraCE (Realising the Transition towards the Circular Economy). His research focuses on Economy at a supply chain level, and with decision-making problems concerning the adoption of Circular Economy practices.

## Andrea Genovese is a Professor of Logistics and Supply Chain Management at the University of Sheffield. He is currently leading as a Principal Investigator some EU funded research projects. His research interests include Operative Decision Support Methodologies for Logistics and Supply Chain Management, Environmental and Social Sustainability in Supply Chains and Production Systems and Multi-Criteria Decision Making methodologies.

## Andrew Brint is a Lecturer in Operations Management at the University of Sheffield. Andrew´s research interests include; Infrastructure Asset Management, particularly with regard to electricity distribution networks; the effects of asking and reservation prices in auctions and bargaining, especially for houses.

1. http://www.circulary.eu/project [↑](#footnote-ref-1)
2. http://circle-lab.com/knowledge-hub [↑](#footnote-ref-2)
3. https://fortune.com/global500/2019 [↑](#footnote-ref-3)
4. https://www.globalreporting.org/standards/ [↑](#footnote-ref-4)
5. https://www.ellenmacarthurfoundation.org/our-work/activities/ce100 [↑](#footnote-ref-5)
6. https://www.ing.com/Newsroom/News/ING-talks-climate-in-Katowice-at-COP24.htm [↑](#footnote-ref-6)
7. See, for instance: https://www.theguardian.com/science/2019/sep/08/producers-keep-sustainable-practices-secret [↑](#footnote-ref-7)