# Guest editorial

## 1. Circular economy and sustainability innovation

### *1.1 Introduction*

This special issue aims to contribute to the existing literature on the nexus of Circular Economy (CE) and Sustainability Innovation. CE has largely taken the attention of scholars and practitioners because of its restorative environmental character as economic model to produce and consume, which is different to the current "linear" economic model of "take-make-use-dispose". The transition from linear to circular production and consumption patterns requires a great deal of innovations at all societal levels, e.g. new technologies, new business models, new policy instruments, different organizational structures and different consumer mind-set.

At present, some Nordic countries (Denmark, The Netherlands, Ireland, among others) show to be at the front in the transition toward circularity, receiving the attention of international organizations. At global scale, "Circle Economy and Shifting paradigms (2018)" launched a metric for the circular state of the planet, that provides a framework to measure and monitor progress in bridging the "circularity gap" (CG) on a yearly basis. Only 9.1 per cent of our current world economy is circular according to such metric. By closing the CG, it is expected to prevent further environmental degradation and social inequality, but this can only happen by engaging the multi-stakeholders in the circular economy model and by deploying technological and organizational innovations. Therefore, our interest to identify studies that try to show the interrelationships between CE and (sustainable)[1] innovations, in specific while addressing water, energy and governance challenges. For this purpose, we selected papers describing empirical cases from Indonesia, Mexico and The Netherlands. These cases are discussed in Section 2 of this paper to illustrate how CE is trigging technical and managerial innovations. Nevertheless, it is also relevant to provide a conceptual framework to the main topics of this special issue: CE in section 1.2 and (sustainable) innovation is presented in section 1.3.

### *1.2 The concept of circular economy*

In this section, the concept of Circular Economy (CE) is visited but just to, in general, situate the reader. Each of the papers in this special issue makes its own conceptual revision in a more extensive way to elaborate on their research objectives.

Scholars have reported that the CE concept was coined longer than 20 years ago, although its birthplace cannot geographically be pointed out, some scholars gave the credit to China for the concept. China possesses one of the most aligned strategies toward CE, through regulatory and institutional settings. However, the best CE practices currently occur in Europe, which are, for many studies, associated to the Cradle to Cradle principles (McDonough and Braungart, 2002). European National governments are presently developing policies and regulations which support the implementation of CE. In January 2018, the European Commission has adopted a set of measures to support the transition[2] of the European countries toward CE.

Additionally, international organizations, i.e. Ellen MacArthur Foundation and McKinsey & Co., actively search and develop conceptual frameworks to illustrate the CE advantages. At this regard, one of the most accepted concepts of CE is the one published by Ellen MacArthur Foundation (2017):

> [. . .] a circular economy aims to redefine growth, focusing on positive society-wide benefits. It entails gradually decoupling economic activity from the consumption of finite resources, and designing waste out of the system.

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In relation to the CE beneficial effects, several organizations have dedicated efforts to identify circular business models, Accenture is one of them and published five of those business models which are:

(1) circular supplies;
(2) resource recovery;
(3) product life extension;
(4) sharing platforms; and
(5) product as a service.

The creation of new business models under CE tenets has been very proactive, e.g. Mentink (2014) introduced 19 different CE business models.

At present, because of the pressures of society and policies, CE has been a source of *inspirational innovation* because it enables businesses to be competitive by implementing systematic circular ways of production and consumption, while simultaneously CE helps to improve the businesses co-relationships with the environment.

*1.3 Innovation, eco-innovation and other related terms*

Generally speaking, *innovation* has been directly associated to Economics, to the productivity and competitive level of a country, this was also extensively discussed by Joseph Schumpeter (1943). He argued that economic growth depends on technological change and evolving institutions. Under this premise, the *innovation economics* theory emerged in the past decade. The leading theorists in this field formulate that innovative capacity (Ahlstrom, 2010) moves the economic growth rather than capital accumulation, as neoclassical economists claimed. In innovation economics, the main focus is, in fact, the innovative capacity to create more effective processes, products, business models, all that based on knowledge/technology (R&D, patents). As an example of innovation economics, the German biotech industry can be here mentioned when Germany provided R&D subsidies to create collaborative clusters of joint projects, increasing significantly the patent performance of this industry (Fornahl *et al.*, 2011). This successful case put in evidence the concerted efforts of markets, institutions and policymakers within a geographical area. Even further, industrial and metropolitan areas are regarded by some scholars (Mark *et al.*, 2008) as sources of innovation because of the presence of human capital, production structures and public infrastructure that creates innovation systems through the supply-side to satisfy the consumer-demand-side in the provision of services, e.g. water systems, energy supply, infrastructure for transportation, etcetera. Though, innovation is also influenced by other drivers as for example the scarcity of resources or broader requirements from society.

In line with innovations applicable to the CE purposes, several concepts emerged around the term of *eco-innovation*, which appears to be the most used in relation to the environmental concerns. Although concepts as green-innovation, environmental innovation, sustainable innovation seem to be different to the one of eco-innovation, the baseline of all of them is the development of eco-innovations and social practices to enable societies to become sustainable (Boons and Lüdeke-Freund, 2013). Consequently and for practical reasons, the concept here reviewed is the one of Eco-innovation.

One of the first appearances of the eco-innovation concept is in the book by Fussler and James (1996) who defined it as the creation of business and customer value with significant reduced environmental impacts. While James focused on the environmental benefits of the eco-innovation, there were other scholars who frame it in a broader sense of the sustainable development paradigm. Rennings (2000), for instance, is one of them; he stated that eco-innovation trigged three types of changes: technological, social and institutional innovation. At national scale, some

countries have defined their own concept of eco-innovation to develop related policies, as an example, here the definition pronounced by the Government of Denmark[3]:

> [...] eco-innovations are the efficient technologies that directly or indirectly lead to improving the environment, for example: pollution control, more environmentally friendly products and processes, more efficient resource management, and technological systems to reduce the environmental impacts.

In this definition, there is a strong focus on reducing environmental impacts, though it can be said that, it is not necessarily the priority objective of an eco-efficient technology.

Nevertheless, innovation is also *sustainability driven* as it has been studying by Little, who, since 1999, surveys companies to investigate how they consider sustainability in their approach of innovation management. In fact, the definition used in his research is *sustainability-driven innovation* which means the *creation of new market space, products and services or processes driven by social, environmental or sustainability issues*.

## 2. Overview of the papers

In this section, a brief introduction to the five papers composing this special issue is provided where the first four papers focus on *eco-innovation* approaches related to water and energy and the final paper addresses a broader approach and can be classified as *sustainability-driven innovation* type. Indeed, the three first papers were inspired on water innovations, while the fourth describes the case of organic farming wastes transformation into energy source and the fifth paper pays attention to governance instruments and their perception in two types of market economies: liberal and coordinated.

### *2.1 Water innovations*

The *first paper* is written by Gleason and Casiano in which they analyzed the importance of urban rainwater harvesting under circular economy tenets, as a restorative approach to the water cycle in urban areas. They used the metropolitan area of Guadalajara, Mexico, as case study (the second largest metropolitan urban area in Mexico). This area suffers from frequent floods with yearly cost over US$26m, while water demand has a production cost of about US$24m. As part of hydrological studies, it has been observed that aquifers are drying because of uncontrolled urbanization and increasing the impervious area over the recharge zones. In addition, rainwater is combined with wastewater, elevating the cost of the wastewater treatment because the amount and quality of water to treat exceeds the systems' capacity. This situation causes floods and decreases the availability of ground water. These problems are reflected in the imbalance of parameters of water cycle and a new approach is needed. The circular economy model can help to preserve one of the most vital (water) resources. Scarcity is already so pronounced that they cannot reach many of the desired economic, social and environmental goals. Technologies that help balance supply and demand can also help water (both stock and flow) to become part of a circular model. To prove this, Gleason and Casiano present a hypothetical scenario based on a pilot project and a basin modeling of Guadalajara Mexico. They claim to demonstrate that rainwater harvesting can play an important role in Circular Economy. By using the rainwater catchment systems, they can decrease the cost of damages caused by floods, reduce the demand of water, reduce its cost of production, recharge the aquifers and improve the wastewater treatments. With this experience, Gleason and Casiano show physical evidence about rainwater harvesting systems that can be associated with the Circular Economy concept.

The *second paper* relates also to water innovations and is written by Casiano and Bressers whose paper's title is "Towards Circular Economy – a wastewater treatment perspective, the Presa Guadalupe case". The authors focus on how the wastewater treatment plant policy, from a Circular Economy (CE) perspective, is affected by the governance

context. In particular they looked at the Presa Guadalupe sub-basin as a case study. But in general, it was found that in Mexico, only 19.3 per cent of industrial water is treated (GreenPeace, 2014, pp. 3-4), while approximately 50 per cent of municipal waste water has some treatment (CONAGUA, 2014). From literature, it was identified that CE can contribute to water innovations that help to improve water quality. However, such benefits are not easily achieved. The Presa Guadalupe sub-basin provides an example of the complexity and challenges that the implementation of a CE model can face. In the findings, it was distinguished that the wastewater treatment plant policy plays an important role in a CE model. Some incentives are already in place, however the hurdles of a top-down implementation perspective, low availability of resources, prioritization of short-term results, lack of enforcement of the "polluter pays" principle and a linear model of water systems need to be overcome. The path toward CE from a wastewater treatment plant perspective implies the creation of synergies among stakeholders. However, the issues mentioned in this paper need to be solved to face the current situation, where a wastewater treatment policy from a CE perspective seems to be still distant.

Water innovation under the context of CE in Indonesia was the object of the *third paper*, written by Eneng Rahmi and collaborators. The purpose of this paper "is to describe and explain the relative water scarcity condition as one of the main problems encountered in Indonesia. It is caused by fierce competition between water users, water over consumption and high water price. The water conflict and increasing phenomena of relative water scarcity result on unequal access to water between the rich and the poor. This research is intended to contribute to a balanced water governance system that secures equal and fair access to water resources for all users. The results of this research indicate that water policies and implementation are lacking of coherency. It is also shown that the complex government structure with responsibilities divided over multiple agencies is responsible for this. The CE approach gives an alternative solution for relative water scarcity by a revolutionary change in ways of thinking on internal and external water management. Elements of this consist of increasing added value of water, creating incentives and disincentives to reduce water pollution and water use, rising the knowledge to create an evolutionary process from linear to circular (in external action) and also a top-down and bottom-up approach used in making decisions on developing the city. The evolutionary change of thinking should include a change of the social and cultural habits so that rain water can be an alternative water source for domestic use instead of the springs. Also the government and the private sector can take the benefit from rainwater as a source when it is used wisely by sustainable water management underpinned by production.

### *2.2 Energy innovations*

*Yazan and collaborators* wrote the *forth paper* included in this special issue. This paper aims at:

- understanding the implementation of a circular economic business where animal manure is used to produce biogas and alternative fertilizer in a regional network of manure suppliers and biogas producers; and
- revealing the impacts of five variables (manure quantity, transportation distance, manure dry content, manure price and manure discharge price) on the economic sustainability of manure-based biogas supply chains.

Some of their highlighted findings showed that cooperative initiatives are profitable for large-scale farms (>20000 t/year) if biogas producer (*b*) pays farmer (*f*) to receive its manure (€5/t) or if *f* sells manure for free and manure disposal costs are >10 €/t. Cooperation is always profitable for *b* if *f* pays *b* to supply its manure (€5/t). If *b* receives manure for free,

benefits are always positive if *b* is a medium-large-scale plant (>20000 t/year). For a small-scale plant, benefits are positive if manure dry content (MDC) is >=12 per cent and transportation distance is <=10 km. To conclude, the authors indicated that while the production of bioenergy from manure via anaerobic digestion has been largely studied in the literature, few studies have investigated the cooperation dynamics among actors within the manure-based biogas supply chain. This paper fills up such gap to understand under which conditions cooperation can be beneficial or detrimental to actors involved in the supply chain. The benefits of the cooperation are strongly influenced by several technical, operational and economic variables whose impacts are quantified via scenario analysis. This also means different levels of bargaining power and willingness-to-cooperate for each supplier and biogas plant representative. Further research aims at extending this study to a more complex scenario in which more suppliers and buyers are involved in a network.

*2.3 Governance innovation*

In the *fifth* and final paper, Bjorn *et al*, look at the perception of Corporate Social Responsibility (CSR) as a Signpost for Circular Economy with the purpose to identify managerial implications for multinational corporations (MNCs) with regard to circular economy (CE). These managerial implications can contribute to the linking of CSR and CE strategies for MNCs. This is an empirical study with a mixed methods approach using both quantitative and qualitative research elements. The varieties of capitalism approach (VOC) with its two kinds of market economies – liberal (LME) and coordinated (CME) – builds the theoretical foundation. The main findings showed that all three guiding hypotheses of the quantitative research part are confirmed, which are:

(1) There is a differing perception of CSR in the two kinds of VOC.

(2) LME corporations adopt a shareholder value perspective.

(3) CME corporations adopt a stakeholder values perspective.

Furthermore, the qualitative research part has identified several key success factors for strategically conducting CSR in nexus with CE. These findings are important to take into consideration when discussing CE because corporations in LMEs and CMEs find themselves in different institutional contexts that put them into distinct situations. Whereas CMEs provide a more fruitful field to cultivate CE, LMEs have a less evolved background. Moreover, CE is strongly focusing on the environmental facet. Such emphasis might also be more prominent in CMEs than in LMEs. While the institutional context in CMEs is thus supporting the CE emergence and evolution, LMEs seem to be strongly dependent on pioneering corporations to get CE on the agenda and increase the awareness for the concept.

All in all, this paper provides a first look at how to connect scientific findings with regard to CSR nexus CE tenets. It provides an approach to overtake certain findings concerning strategic CSR into the CE framework. Nevertheless, this paper dips the first academic toes in what still seems to be mostly unexplored and undiscovered waters of connecting CE with an institutional theoretical framework of two kinds of market economies. For future research, it will be exciting to examine if there are certain institutional drivers that shape the core areas, the extent and the general nature of CE strategies. Consequently, it will be interesting to see which and how many forms of CE will evolve from the pioneering stage in which the concept still is.

## 3. Concluding remarks

A growing number of publications describe CE either from a dis-materialization perspective or from the novelty of its business models rather than stretching out its innovative potential

toward sustainability as it is illustrated in this special issue. The sustainability term, indeed, calls for implementation of governance principles to tackle and solve environmental, economic and social challenges, in this case in connection to CE. In other words, CE is in this special issue regarded from different societal actors' interests which go beyond:

- managing efficiently the regional natural resources;
- keeping materials' value in the life cycle of products; and
- avoiding waste generation.

Moreover, this special issue targets different groups, from practitioners who are looking to learn from previous examples to apply the CE framework to their reality, unto academics who want to understand what are the enabling conditions and factors of CE to ignite *sustainability-driven innovations*.

The multi-disciplinarity of the papers of this special issue tries to show the need to integrate diverse theories and expertise fields into the analysis of the CE cases. Even further, the CE implementation requires knowledge from diverse disciplines, which is at the same time the basis of any type of innovations. This to say, that there are certainly nexus between the two concepts (CE and innovations) but it is clear that CE depends on innovation systems rather than on the other way around. Therefore, to overcome the circularity gap (CG), explained in Section 1, it is crucial to have robust (sustainable) innovation development programmes that can cope with CE opportunities.

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## Notes

1. Innovations addressing environmental, social and economic issues.
2. http://ec.europa.eu/environment/circular-economy/index_en.htm
3. White paper "Promoting Eco-efficient technology – The Road to a Better Environment" (2006).

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## Further reading

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