

Rethinking Systems for a Circular Economy

R. ROWLAND, J. KUHLMANN

Fachhochschule Burgenland, Eisenstadt, Austria

ABSTRACT: The circular economy (CE) concerns rethinking how we design, produce, consume and (re-) use resources, products, services, processes and whole systems that not only work more efficiently than is possible through linear economic models, but also re-generate the natural environment upon which life depends.

Currently, the CE practice focuses on designing biological and materials cycles, but it also impacts the social fabric at large and requires whole-system transformation of the world as we know it, such as, for instance, the development of a new open banking system conceived through society's demand for transparency and achieved through circular thinking on a system level that goes beyond disciplinary, geographic, or cultural boundaries. CE practice encourages an orientation towards collaboration and service instead of competition and ownership – leading to product and process optimizations that are based on smart knowledge and collaborative information management.

A particular challenge for the CE concept to spread across industries are the constraints of the traditional legal frame that supports the linear economy which, in turn, is based on competition. Therefore, it is difficult to apply traditional laws to the new requirements of transparency and collaboration in CE business models. While traditional contracts and other legal agreements work perfectly well in the existing economic environment, they may not deliver the desired results in a circular economy. The more sophisticated analysis of data extracted from returned parts and materials will need to lead to an even more responsible use of data. While radical thinking is required to turn outdated business models upside down and inside out, a fundamental redesign of the existing legal frame may not be required. Instead, it may suffice to define the differences between the linear and the circular models and use existing tenets to imagine future legal challenges for which traditional frames can simply be expanded.

So, how can we get there? Aligned with the CE framework, processes and tools for systemic collaborative circular innovation exist. Design challenges have changed in scale from products and services used by individuals to networks and whole systems in which actors interact across boundaries. This is to say that on a system level, it is important to become aware of the interrelationships between the parts that form the system, so that the complexity of the situation can be understood and the desired outcomes can be achieved. To understand how communication happens within these networks we might learn from nature—such as, for instance, how ecosystem services are based on intrinsically interconnected and interdependent relationships. The nature-inspired biomimicry thinking innovation process is part of the CE toolbox for circular innovation and provides a roadmap for abstracting nature's strategies into future-fit human-made products, services, processes, and systems that lead to sustainable futures.

1. CIRCULAR ECONOMY FRAMEWORK AND PRACTICE

In order to discuss the circular economy, it is first useful to study the infographic that visually outlines the concept, called the CE Butterfly diagram. It shows the details of the two wings of biological and technical cycles that form the core of the CE concept.

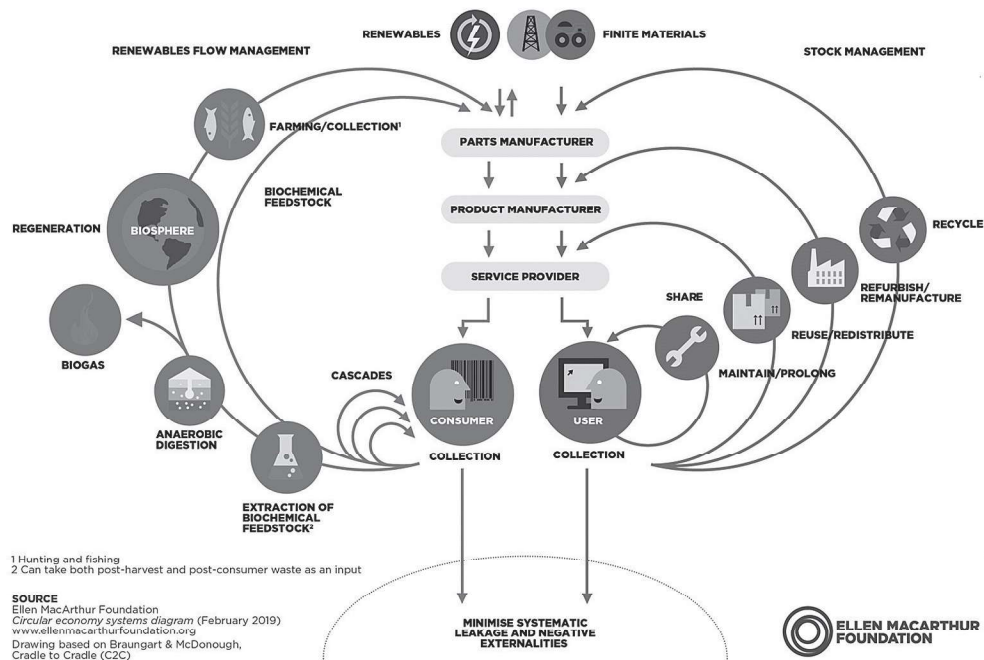


Fig. 1: System diagram of the circular economy – 'Butterfly Diagram' (Ellen MacArthur Foundation, 2019).

1.1 THE 3 PRINCIPLES OF THE CE

In comparison to the traditional industry and business-as-usual practices of the linear economy that are based upon "heat-beat-and-treat" production and "take-make-and-waste" consumption, CE is based on the principles of designing out waste and pollution, keeping products and materials in use, and regenerating natural systems in the ways nature would do (Ellen MacArthur Foundation, n.d.).

CE Principle 1 is about designing out waste and pollution in (concrete and abstract) human activities. The majority of the work concerning this principle happens up front, during the design phase. Required here are methods for circular innovation, such as the biomimicry thinking innovation process.

CE Principle 2 concerns keeping products and materials in use. While some products can be designed for being reused, repaired and remanufactured, others require that materials, such as packaging, are returned to the biological and technical cycles instead of landfills. Required here are not only circular design methods but also circular reallocation and redistribution operating methods that yield business opportunities with aligned legal structures.

CE Principle 3 relates to regenerating the natural systems that all living organisms depend on. In nature, there is no waste, all materials are composed of the basic building blocks of life, such as the four most common ones hydrogen, carbon, nitrogen, and oxygen (Baumeister, 2013), and decomposed into these basic elements again along the food chain of all organisms in an ecosystem. In this process of composing and decomposing, valuable nutrients are returned to the soil and as a result enrich natural resources. Required here is a basic understanding of how life works and adhering to, for instance, the 26 biomimicry life principles.

For each of these principles, methods and tools are available for designing sustainable futures. While transformative change is necessary on all levels of human activity, and while this shift may challenge people in most areas of their lives, it is not only possible to mimick nature's patterns, it can also be perceived as opportunities for experiencing healthier and happier lives. What is required here is a collective reframe of the role that humans play in the web of life – a fundamental change of heart and mind and a shift towards

ever greater awareness about the inter-connectedness and inter-dependence of all living beings on planet earth, described in human systems as thriving (a state of wellbeing aligned with living system health) (Russel, 2013).

1.2 SOME EXAMPLES FOR THE TWO WINGS OF THE CE BUTTERFLY DIAGRAM

The Butterfly Diagram shows how human production and consumption could emulate nature's circular processes where all waste becomes food for others in the system. The infographic is composed of a series of circles that remind of the wings of a butterfly.

The principles outlined and illustrated in Fig. 1 can be found in business ideas old and new all over the world. To make this diagram more tangible, the following examples further illustrate how a circular economy might be realized. This shortlist of examples is based solely on the authors' personal experiences and/or choices, and as such a highly-reduced list of samples.

1.2.1 Biochemical Feedstock (*left wing of the butterfly diagram*)

Hut und Stiel (www.hutundstiel.at) collects coffee grounds from Viennese restaurants and bars and uses them as a substrate to grow oyster mushrooms, which are then sold to local restaurants.

The collection of waste oil is another example of the biological cycle, where biological resources that were used for one purpose (cooking) are then collected and transformed into something new, namely soap, bio diesel or bio gas. There are several businesses (e.g. www.agra-entsorgung.at) and also municipalities that offer this service.

1.2.2 Regeneration of the Natural Environment (*left wing of the diagram*)

Greentree (www.greentree.at) offers living Christmas trees for the holidays for a reasonable price that includes delivery and pick-up after use, tree-renters have the choice of asking for the same tree year after year; and it is also an option to keep (buy) the tree. During the year, the trees are cared for at the farm.

1.2.3 Maintain/Prolong (*right wing of the diagram*)

Fairphone (www.fairphone.com) designs smartphones in such a way that it is easy for the consumer to repair their phones themselves. Following their leitmotif ("The most sustainable phone is the one you already own") they provide an ample selection of spare parts, video tutorials on how to carry out the most common repairs, as well as a community website where users can exchange information on how to prolong the life cycle of their phones.

1.2.4 Reuse/Redistribute (*right wing of the diagram*)

Manitober (www.manitober.de) is a children's clothing brand. It offers a lifetime return policy: after using the products, they can be returned. Depending on their condition, they are cleaned, (sometimes) repaired and again offered to the market for a reduced price, notably with a one-year warranty.

1.2.5 Refurbish/Remanufacture (*right wing of the diagram*)

Refurbed (www.refurbed.at) offers a platform for buyers and sellers of refurbished smartphones, laptops and tablets with a one-year warranty. The data on the products are erased and the devices are then remanufactured using (mostly) original spare parts.

1.2.6 Recycling (*right wing of the diagram*)

The concept of recycling does not need any additional examples. However, it is understood within the circular economy that recycling is the low hanging fruit with the least impact, it only is considered when all the other options (with higher impact) have been exploited.

Companies working with such new models also have to think about what legal ramifications come with their business model. The following section offers some examples of the challenges ahead.

2. RETHINKING THE LEGAL PARAMETERS TO SUPPORT A CIRCULAR ECONOMY

2.1 THE LEGAL RUB IN THE CE

Whenever there is the need for change emerging in (economic) systems it is met with insecurities. For instance, digitalisation has led to radical changes in society in recent decades. After several years of digital transformation, more and more legal issues have been identified and eventually addressed. The rules of the analogue economy did not provide for satisfying legal solutions to deal with certain virtual concepts, such as virtual companies, intellectual property rights, and artificial intelligence. Therefore, the European Union acted and designed the so-called Digital Single Market Strategy (European Commission, 2015a). The same steps may now be upon the notion of a circular economy as the new emerging concepts stand in opposition to the current linear economy and its underlying assumptions.

When faced with a radical system change, lawmakers usually take one of two roads. They either make more specific regulations trying to grasp the specifics of a certain development and shape them according to (already perceived) needs, or they wait until it becomes clear whether the original legal structure provides a frame for the emerging challenges in the new environment. As was – and still is – the case with digitalisation, the European Commission published a so-called Circular Economy Package in 2015 in order to contribute “to the EU’s efforts to develop a sustainable, low carbon, resource-efficient and competitive economy” (European Commission, 2015b). It included an action plan with 54 measures. The priority sectors identified were plastics, food waste, critical raw materials, construction and demolition, biomass and bio-based products (European Commission, 2019). It focused on reducing waste through (eco-)design, production process and reusing waste. It did not touch on the vital question on how to organise an economy with little to zero waste (Rizos et al., 2016). Emerging concepts of circular business ideas offer solutions that are not easily accommodated within the currently predominant legal notions of ownership or competition. One of the challenges during a transition to a circular economy are the (re-)definition and/or expansion of legal structures to support these new business models.

2.2 OWNERSHIP AND COMPETITION IN A CIRCULAR ECONOMY

From a legal point of view, ownership is only one right *in rem* (a right *in rem* confers a person the right to exclude all other persons from doing something with a certain thing), but it is the most powerful one as it permits owners the full discretion for the object (or right) they own; most importantly, they can exclude any other person from using this object or right in any possible way. In a world of finite resources, however, an exclusive right that allows for – in most cases – unrestricted possession, use, enjoyment and disposal may not be the best solution. The notion of a circular economy strongly challenges the concept of the kind of ownership that has been a cornerstone of Western economies for centuries.

Looking at the examples in section 1.2, it becomes obvious that businesses in a circular economy tend to not think in terms of ownership. CE heavily relies on performance-oriented business models (Planing, 2015) where contracting partners design legal agreements focusing on the use of the product and the services it can provide instead of entering purchase agreements that transfer ownership from the seller to the buyer. These new types of (circular) contracts include aspects of established legal instruments such as rent, lease or usufruct (the legal right to use and enjoy the profits of something that belongs to another person), and the relationship between the parties is fairly long-term and closer than within the framework of an ordinary purchase agreement designed for a linear economy. Compared to such traditional agreements, these new contracts have to be much more elaborate to secure the vital interests of all involved parties (Lahti et al., 2018).

While consumers tend to prefer not to be bothered with all the obligations that come with ownership, it is the small and medium-sized enterprises that are having a hard time in a business environment where a lot of decisions are made based on specific performance figures. On the one hand, companies that own less have a lower asset base and little collateral. On the other hand, companies that own all their products while not being in their possession, are not in control of their ownership. Both types of owners experience difficulties

when trying to obtain loans from commercial banks as their business plans differ significantly from those of businesses based on the linear economy (Rizos et al., 2016). Consequently, a reassessment of ownership in certain fields, e.g. accounting, should be considered for a transition to a circular economy (Kok et al., 2013). It goes without saying that banks, likewise, need to develop different models and relationships with their customers in order to be of service to the new deal.

Competition is a policy priority of the EU and its member states. Competition rules prohibit anti-competitive behaviour in forms of cartels, abuse of dominant positions, mergers and state aid. These rules are not only vital for the EU's internal market, but universal to most if not all Western economies. Collaboration is limited by those rules. In CE environment, however, collaboration plays a central role for exchanging goods and services. Hence, there have been calls for redeveloping competition law to enable closer cooperation and/or collaboration (Kok et al., 2013).

Again, it is not entirely clear if there is really a need for new or different legal provisions. The major provision prohibiting cooperation is – at EU level – Article 101 of the Treaty on the Functioning of the European Union (TFEU), which is used as just one example for this short analysis. It prohibits anti-competitive agreements and decisions and renders them void in case they affect trade between EU member states. There is, however, an exception to this rule for agreements or decisions if an agreement (i) improves the production or distribution of goods or promotes technical or economic progress, (ii) allows consumers a fair share of the resulting benefit, (iii) contains only restrictions which are indispensable to the attainment of the agreement's objectives, and (iv) does not afford the parties of the agreement the possibility of eliminating competition in respect of a substantial part of the products in question (Article 101 para 3 TFEU). Given that these four conditions are cumulative, it is unnecessary to examine any other once it is found that one of them is not fulfilled. To answer the question whether this competition rule is potentially hindering cooperation and/or collaboration within the realm of a CE, it is especially important to look at the first condition, because the other three can be different from case to case. The most important question in this context is whether increased sustainability could be considered as an improvement to the production or distribution of goods (services) or the promotion of technical or economic progress.

The guidelines of the European Commission on the application of Article 81 (3) of the Treaty [Article 101 (3) TFEU is the verbatim successor] name two types of efficiency gains in connection with this first condition, namely cost efficiencies and qualitative efficiencies. At the date of issuance of these guidelines, the CE concept was in its infancy. Hence, the examples of qualitative efficiencies focused on technical or technological advances, higher quality products, products with novel features, but also distribution channels. There are probably manifold examples of cooperation or collaboration agreements in CE business models that provide for one or more of these efficiencies; a novel feature could be the reparability of certain smartphones for example. To ensure this reparability, there needs to be an agreement with a specific parts manufacturer that, most likely, includes anti-competitive elements. So, if there is consensus that also more sustainable products could be subsumed under qualitative efficiencies, the test for the other three conditions is not different to any other collaboration agreement. Hence, in principle, there is no need for a radical change in competition law, but only a change in its interpretation considering the new circumstances brought about by the transition to a circular economy. The question here is whether the level of sustainability in a product can be wrapped under the existing legal conditions of qualitative efficiency – and it must also be acknowledged that the status of efficiency is still just one step further than compliance, both being a low-level achievement toward the goal of systemic sustainability (which is reached in stages).

In order to arrive at these different interpretations of the law, one could simply gather a room full of lawyers around a design table and hack away at the boundaries of the law. However, while lawyers are absolutely necessary as subject experts in this process, creative re-thinking of traditional narratives usually does not easily emerge from within the discipline in question—true for all professions. The use of creative engagement methods as applied in collaborative transdisciplinary design thinking processes have proven to be very useful in innovation of all kinds. The next section in this article gives a very brief review of the recommended methods for rethinking systems for the new CE deal.

3. CIRCULAR INNOVATION METHODS

3.1 CIRCULAR INNOVATION SANDBOX

There is a general pattern at the base of all innovation processes, a multi-phased process of finding (and/or redefining) the problem and forming a design challenge, and then finding (and/or creating) an appropriate solution to address the challenge. The UK Design Council has named it the 'Double Diamond' approach to innovation, shown in Fig. 2 (UK Design Council, 2019). Its visual depiction clarifies the steps of human-centered design which begins with contextual research to discover the needs of users for product or service design and/or stakeholders for process or system design, is followed by a definition of the opportunity space for design and specific design criteria before the development of concepts and delivery of prototypes can be completed. Learning from other human-made innovations is part of the process. This kind of process applies traditional visual design theory and practices to the genre of design management in business and other agendas. It is in itself a very successful model for innovation in terms of process design, and goes hand in hand with business modelling to bring innovation to market.

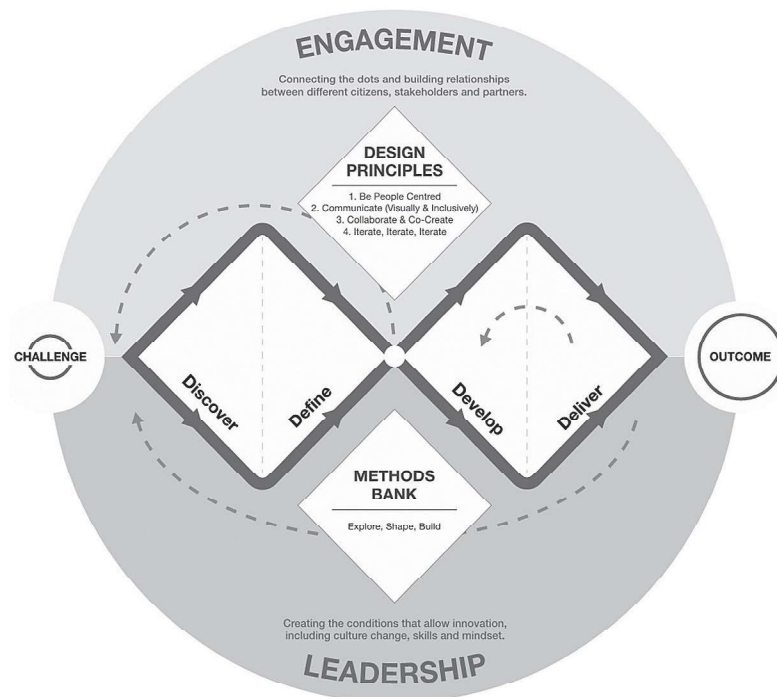


Fig. 2: Framework for innovation – 'Double Diamond approach' (UK Design Council, 2019).

However, what is missing in this and other innovation processes are the millions of genius designs that can be discovered in nature-inspired innovation processes where models for solutions are not adapted from other human systems but emulated from strategies that nature uses to survive and thrive under the operating conditions prevalent on planet earth (Benyus, 1997). The CE community – aware of the need to look to

nature as a rich R&D lab – has included bio-inspired design processes in its circular design guide methods section as a path to successful innovations for sustainable futures (Ellen Mac Arthur Foundation, 2017). The next section in this article elaborates on one of these processes in particular.

3.2 INNOVATION INSPIRED BY NATURE

3.2.1 *Biomimicry Framework*

Biomimicry is one of several ways to innovate bio-inspired forms, products, services, processes and systems into the human world and is underpinned by the premise that life creates conditions conducive to life (Baumann, 2013). It is a theory and a practice for systemic sustainability, bringing together diverse teams from disciplines directly or indirectly connected to the specific design challenge, the system sciences, biology and/or ecology, and the various design disciplines needed at the design table (process designers, product designers, service designers, business strategists, engineers, system designers, etc.).

The philosophy of biomimicry involves looking to nature as a model for inspiration by reconnecting with nature through observations and scientific fieldwork, a mentor to learn from by emulating nature's strategies into human designs, and a measure for sustainability through the use of 26 biomimicry life principles. This sustainability benchmark is the distinguishing feature of biomimicry compared to other bio-inspired design processes, such as bionics or biomimetics (where sustainability concerns are hopefully included but are not mandatory as part of the innovation process).

3.2.2 *Biomimicry Practice*

The biomimicry practice may take one of two particular pathways: 'biology to design' (Baumeister, 2013) where the process begins with an inspirational biological insight gained through learning about and/or observing nature that is then applied to a design (also called biology push and understood as a bottom-up process) (ISO TC266, 2015), and 'challenge to biology' (Baumeister, 2013) where a particular design challenge has been identified for which a bio-inspired solution is sought (also called biology pull and understood as a top-down process) (ISO TC266, 2015).

The biomimicry thinking 'challenge to biology' practice is a four-phased design process engaging a transdisciplinary design team composed of scientists-at-the-design table (naturalist, biologist, ecologist, or other life science specialist), specific designers in support of the type of design challenge (product, service, process, system, engineering, etc...), and representatives of the discipline where the design challenge arises as a problem. Ideally, internal and external stakeholders impacted by the problem would also participate at certain times during the design process. The biomimicry design team collaborates through the phases of scoping, discovering, creating and eventually evaluating against the design criteria and the sustainability benchmark. The various disciplines at the design table distribute leadership throughout the process, so that the team is led by those whose specific knowledge is especially important during a specific step—emulating self-organization, a core principle in nature.

The biomimicry thinking innovation process can be applied to any design challenge, and is as such of special interest also to the legal questions as the process itself would ask the designers of the legal structures to ask new types of questions for which they would look to nature for answers, such as: How is the exchange of nutrients (resources) regulated in a healthy ecosystem? How does nature regulate stocks and flow? Who exchanges what, with whom, and for which purpose? What is the desired outcome (benefit for the whole system) of these exchanges? How would nature write conditions for a fair deal in an ecosystem? What is a fair deal in an ecosystem? How does nature assure that an ecosystem stays healthy and that each participating organism does its part? ...and so forth. Surely, the research results from these investigations would open new windows for considering how the legal foundation of a society and their transactions could lead to sustainable futures. Designers would find that cooperative relationships are at the very core of all healthy ecosystems because in nature everything is interconnected in complex ways, and if any organisms would do it differently they would lead themselves, simply put, into self-destruction. Designers would also find that the dynamics of an ecosystem in nature are determined by the operating conditions of the system, and they might then recognize that the equivalence to society is the underlying pattern of structures that drive the

behavior of people. With this kind of research process, designers would find concrete strategies that nature uses to keep an ecosystem healthy and thriving. It is thus wise to consult nature as a model, mentor, and measure for re-designing organizations and its legal framework in a circular way, so that the social fabric emerging from such structures becomes an interwoven pattern of mutually beneficial relationships. Go nature!

CONCLUSIONS

The CE concept aligns with other currently used sustainability frameworks and can be combined with a variety of methods and tools to help move the agenda of systemic sustainability forward. Depending on who is at the design table, ever more new topics will continue to emerge that need rethinking, so that the linear economy is transformed into a circular one, step by step. Some of this rethinking requires deep transformation, while other issues may only need a reinterpretation for the time being—as some of the examples discussed in this article have shown. While in some instances radical steps will be necessary to turn the boat around on the various crises that are currently playing out in the world at large, it may be helpful to not throw the baby out with the bathwater, but leave some familiar structures standing for people to hold on to while others have to be rebuilt from scratch. There are processes available that help re-invent, re-interpret, re-think and eventually re-do human production and consumption so that sustainable futures become possible, such as the biomimicry thinking design process discussed above. When decisions are being made about the future vis-à-vis the sense of uncertainty people are experiencing at this time, looking to nature provides clues how to design human systems that lead to (global) thriving. Along these lines, nature is considered one of the greatest teachers when it comes to sustainability because all organisms alive today have undergone 3.8 billion years of research to (co-)evolve and thus have already solved the kinds of challenges humanity needs to address now.

REFERENCES

- Baumeister, D. (2013) Biomimicry handbook. Biomimicry 3.8, Missoula, MT, USA.
- Benyus, J. (1997) Biomimicry. Harper Collings, New York, NY, USA.
- Ellen Mac Arthur Foundation (2017, 2018). Circular Design Guide, retrieved from <www.circular-design-guide.com>
- European Commission (2004) Guidelines on the application of Article 81(3) of the Treaty, OJ C 101/97.
- European Commission (2015a) A Digital Single Market Strategy for Europe, COM(2015) 192 final.
- European Commission (2015b) Closing the loop - An EU action plan for the Circular Economy, COM(2015) 614 final.
- European Commission (2019) Commission Staff Working Document accompanying the Report on the implementation of the Circular Economy Action Plan, SWD(2019) 90 final.
- ISO (International Organization for Standardization) TC266 (2015) in ISO 18458:2015: Biomimetics – terminology, concepts and methodology. Beuth Verlag, Berlin, Germany.
- Kok, L.; Worpel, G.; Ten Wolde, E. (2013) Unleashing the Power of the Circular Economy; Report by IMSA Amsterdam for Circle Economy.
- Lahti, T., Wincent, J. & Parida, V. (2018) A Definition and Theoretical Review of the Circular Economy, Value Creation, and Sustainable Business Models: Where Are We Now and Where Should Research Move in the Future? Sustainability 10 (8), 2799-2817.
- Planing, P. (2015) Business Model Innovation in a Circular Economy Reasons for Non-Acceptance of Circular Business Models. Open Journal of Business Model Innovation 1-11.
- Rizos, V., Behrens, A., van der Gaast, W., Hofman, E., Ioannou, A., Kafyeke, T., Flamos, A., Rinaldi, R., Papadellis, S., Hirschnitz-Garbers, M. and Topi, C. (2016) Implementation of Circular Economy Business Models by Small and Medium-Sized Enterprises (SMEs): Barriers and Enablers. Sustainability 8 (11), 1212-1229.

Russel, MJ. (2013) Thrivability. Triarchy Press, Devon, UK.

UK Design Council (2019) The Double Diamond. Retrieved from <https://www.designcouncil.org.uk/news-opinion/what-framework-innovation-design-councils-evolved-double-diamond>

Kontakt Daten Autor(en):

Regina Rowland

Campus 1

7000 Eisenstadt

Email: regina.rowland@fh-burgenland.at

Josefine Kuhlmann

Campus 1

7000 Eisenstadt

Email: josefine.kuhlmann@fh-burgenland.at