

Circular Innovator Education

Why the world needs to educate circular economy thinkers & doers

Sabrina Schork

The following chapter builds on the article Dryver's Seat from Erwin Sengers. He asks for higher education programs that train future self-directed entrepreneurs with the right attitude and the ability to think critically and control their actions. In order to master this challenging task, Erwin asks for conscious trainers who are innovators themselves. Innovators can ask the right critical questions, connect seamlessly unconnected information, and experiment. The following article is a first step towards raising the awareness of these new trainers and giving them methods, tools, and inspiration to develop sustainable innovators who think holistically. Innovators are the proportion of entrepreneurs who do not copy or optimize what already exists but commercialize new technologies or new ideas. Circular innovators are the doers who create systemic innovations solving our current social and ecological crisis.

Sabrina Schork

Thinkers and doers

We don't need numerous general circular economy experts. What we need is thinkers and doers who understand how circular economy principles can be applied in their jobs as engineers, teachers, assembly line workers or fashion designers.

Finnish Innovation Fund SITRA

The term 'innovation' is not new. We have known about it since 200 AD. Perhaps that is why it still follows ancient beliefs, which unfortunately have not yet adapted to our planet's ecological and social conditions. Many countries continue to strive for growth with the help of technology, not questioning the 'why' and 'for what' behind it.

From a study by the Global Footprint Network (2020), it has been known since the 1970s that people need more than one planet for their way of life. The Earth Overshoot Day was marked on August 22nd in 2020. Elhacham et al. (2020) published a study on December 9th, 2020, which, based on a decade-long study, proves that the production of human-made material such as plastic, metal, or asphalt (also known as anthropogenic mass) is greater than the total living biomass worldwide.

Two economists active at MIT, Dennis and Dolores Meadows (1970), together with 17 researchers from six nations, researched humanity's predicament. The Club of Rome funded the project. The scientists dated the ecological collapse of the planet to the year 2030. The five factors environmental pollution, industrial food production, agricultural use, population growth, and the consumption of non-renewable raw materials are not managed simultaneously. Without wanting to agree with this apocalyptic-sounding prediction, we should contribute to getting humanity out of this social and ecological crisis.

According to the Intergovernmental Panel on Climate Change (IPCC), the temperature increases from pre-industrial times till 2017 was around 1°C. A mean global temperature increase between 1.8 (with a range of 1.1-2.9) and 4.0 (with a range of 2.4-6.4) degrees Celsius is assumed by the year 2100 (Umweltbundesamt 2013). Lenton et al. (2019) highlight that politicians, economists, and even some natural scientists have tended to assume that tipping points in the Earth system, such as the loss of the Amazon rainforest or the West Antarctic ice sheet, are of low probability and little understood. In their view, the consideration of tipping points helps to define that humanity is in a climate emergency and strengthens this year's chorus of calls for urgent climate action, from schoolchildren to scientists, cities, and countries. The movie 'The Inconvenient Truth' shows the consequences of decreasing ice sheets and glaciers, such as flooded cities. In addition to the ecological crisis, a social crisis has also arisen due to a redistribution of money taking place through industrialisation and 'technologisation'. Today, one fifth of companies own 85% of capital (Göpel 2020). This imbalance leads to extremes at the political level that are confronting each other. Liberalism and populism are no longer trying to understand each other but are fighting among themselves (Reckwitz 2020), which is unsettling humanity, in addition to the corona pandemic.

The proposals for a new economic or political system combined with a new legal framework are increasing. Reckwitz (2020) calls for integrated liberalism that sets a framework for globalisation dynamics and creates a new social regulatory framework. Göpel (2020) calls for a global economy that aligns the sense and purpose of innovations with our time's ecological and social challenges. Both Göpel and Reckwitz (2020) call for a social contract to be drawn up that can cross national borders.

An ethical education can develop thinkers and doers in order to handle the political and social crisis constructively with a positive mindset that is also morally justified. This can lead to a new wave of meaningful circular innovations (CIN) evolving that enables our planet to recover. The term 'ESG', which stands for ecological, social, and governmental criteria, has already established itself in companies as the standard for sustainable investments, which gives reason to hope. So as to get closer to this target, historically processed research is presented in the direction of Circular Innovation (CI) and deals with promising research projects and publications that give hope to catch up with humankind's failure of the last fifty years. This book's contribution aims to develop initial suggestions as to how a state education system could solve the existing problem on a global level. Just like anybody, the planet is a brilliant regenerating system, with or without people. If humans do not change our thinking and act immediately, the planet will advance without us, not leaving much freedom of choice.

What is innovation on a global scale?

'Innovation' is a term that comes from church Latin. It appeared around 200 AD and meant change or renewal. Joseph Alois Schumpeter, who lived between 1883-1950, researched innovations in production processes and defined the term as a new combination of existing factors. Innovations are, therefore, new and different combinations of the available 'things and forces.'

So, innovation encompasses the following five cases for Schumpeter (1961):

- Manufacture of a new product or a new product quality
- Introduction of a new, as yet unknown production method (but does not have to be based on an invention)
- Development of a new sales market in which a branch of industry was not yet introduced (regardless of whether this market already existed or not)

- Development of a new source of supply for raw materials or semi-finished products
- Implementation of a reorganisation (e.g., creation or abolition of a monopoly).

Although the term innovation has gained various new aspects in scientific discussion, the most talked about dimensions are product, process, or service innovation (Hauschildt & Gemünden 2011; OECD 2005). Business model innovation is a separate discipline. Moreover, the integration of social or ecological factors is discussed in sustainability research, which is still a niche, not a mass phenomenon. Innovations include the commercialisation of a new idea or technology (MIT OpenCourse 2013). In order to create innovations, individuals with the appropriate skills and innovation-promoting systems (cf. Amabile 1988; Goller & Bessant 2017) or ecosystems (cf. Nielsen & Meehan 2015; Adner & Kapoor 2010) are required.

Innovations and their business models, in particular, are only successful if there are balanced partnerships in the ecosystem, which in today's world operate across the globe. Thus, we can no longer speak of a country-specific innovation economy. Instead, we have to learn to understand them in global cooperation circulation and create suitable economic and legal frameworks. The behaviour of every country influences the shared planet as well as living beings, plants, and people living on it.

Science already proved that innovation results from the co-creation process of diverse open mindsets that hold spiritual, emotional, and intellectual intelligence.
Scharmer 2013

The five critical innovation skills from innovators are (Dyer et al. 2019):

1. Questioning the status quo;
2. Observing the world like anthropologists;
3. Networking with diverse people to get new ideas;
4. Experimenting in small, fast, and cheap ways to reach novel solutions;
5. Connecting typically unconnected insights to deliver disruptive new business ideas.

How can we nurture a circular innovation ecosystem?

The general concept underlying the circular economy has been developed by many thought schools, such as Regenerative Design, Performance Economic, Cradle to Cradle, Industrial Ecology, Biomimicry, Blue Economic, Permaculture, Natural Capitalism, Industrial Metabolism, and Industrial Symbiosis. Those schools of thought are complementary to each other and provide the foundation for the main principles of this new approach to the economy:

- Designing out waste/designing for reuse
- Building resilience through diversity
- Relying on energy from renewable sources
- Thinking in systems
- Waste is food/thinking in cascades/sharing values (Lewandowski 2015).

By definition, Circular Economy (CE) promotes resource minimisation and the adoption of cleaner technologies while maintaining the value of products, materials, and resources in the economy for as long as possible, as well as minimising waste generation (Santonen et al. 2017). Kirchherr et al. (2017) find 114 CE definitions. To overcome this challenge, Masi et al. (2017) focus on the interconnecting goals and principles central to supporting a shared CE vision. They include:

1. Replacing linear systems with intentionally designed regenerative and restorative circular systems,
2. Decoupling economic growth from non-renewable material throughput and environmental degradation,
3. Increasing system resilience, and
4. Maximizing value creation, capture, and recovery across economic, social and ecological values. These four goals indicate a systemic approach (Brown et al. 2019).

CIs are defined as ‘a continuous and systematic approach to design, develop and commercialise sustainable products, services or processes that contribute to the transformation from a linear to a circular economy or society’ (Löwik 2020). This definition consists of three elements:

1. the development is the capability in a network, not of an individual
2. the solution is commercialised
3. the commercialised output contributes to the transformation from a linear to a circular economy and society.

Diverse, bright minds worldwide started to work out frameworks for the education of Circular Innovators. A distinction must be made between the CI definition of Löwik (2020) and the circular-oriented innovation definition of Brown et al. (2019).

Brown et al. (2019) define the circular oriented innovations ‘as the coordinated activities to integrate CE goals, principles, and recovery strategies into technical and market-based innovations, such that the circular products and services that are brought to market purposefully maintain product integrity and value capture potential across the full life cycle.’

While Löwik (2020) wants to develop the linear economy into a circular one through novel solutions and thus speaks more of systemically changing innovations, Brown and colleagues (2019) call for integrating CE principles and goals into the development processes of a product or service.

Where do we start from?

Different approaches developed in science can be combined so that a new education program arises that meets the demands of this decade (integrating ethical aspects and using the ongoing crisis as an opportunity for new CIN). This new school of thought should reduce linear innovations and increase the development of circular and/or circular-oriented innovations from responsibly acting innovators.

Problem & Question From questions to solutions

We ask ourselves how to anchor the development of ecologically and socially sustainable circular innovations in the state education system as early as possible, across national borders. To this end, we examine a range of scientific articles of our time concerning empirical values in applying methods that would help in the development of a Circular Innovator Education Program or research projects that are already working on CIs.

Meta-Analysis Scientific Publications analysing existing knowledge and publications

The keywords ‘circular’, ‘innovation’, and ‘education’ were examined on Google scholar, Researchgate, and Academia.edu. The results are aggregated in Table 1.

Table 1. Overview of the Online Search Result

<i>Google Scholar</i>	<i>Researchgate</i>	<i>Academia</i>
96 out of 603,000	6	5 out of 1,211

There are 107 publications fitting the chapter topic from which 74 were accessible online. Based on a first initial screening, 40 publications were identified, from which eight were analysed in detail with a second screening. The criteria of the first screening were that: the publication is focused on circular economy and innovation, the publication consists of a tool, method, approach, or education formats. In the 2nd screening the criteria were extended by two factors, 1.) the tool must be scientifically developed and 2.) the tool has been validated. In the following Table 2, the eight shortlisted publications which meet the first and second screening criteria are presented.

Table 2. Overview of the shortlisted publications

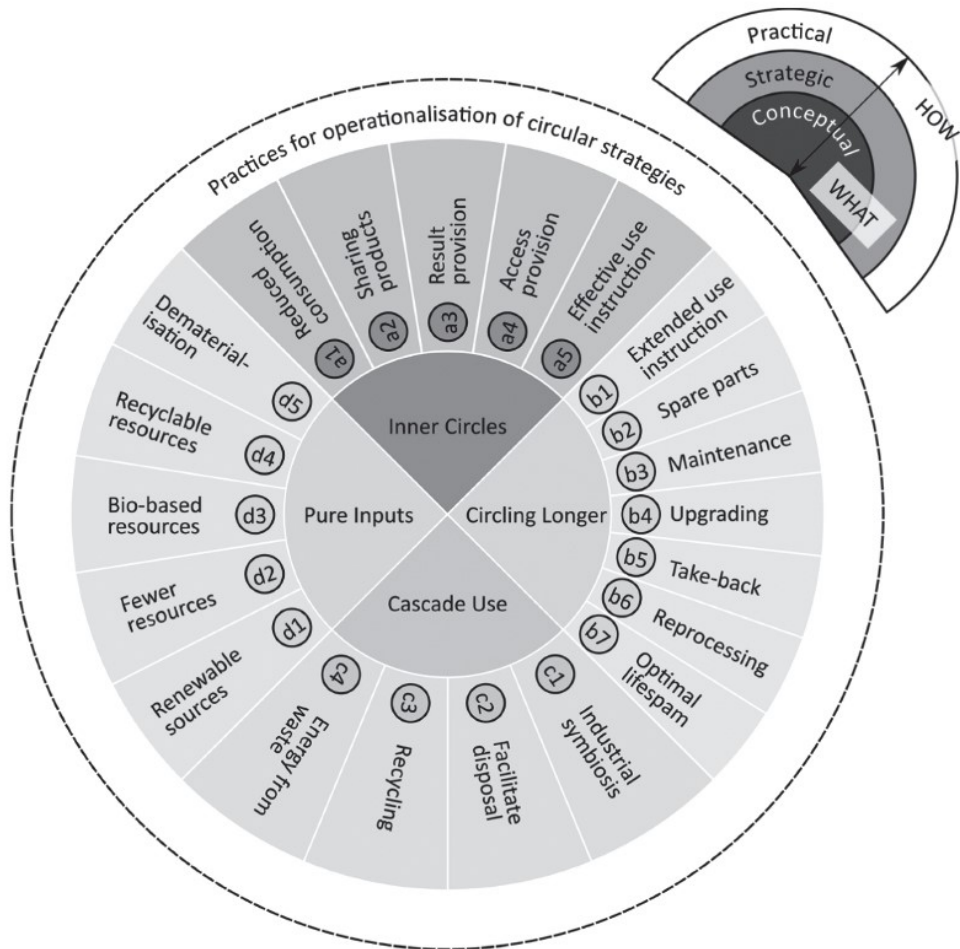
<i>No.</i>	<i>Authors</i>	<i>Year</i>	<i>Title</i>
1	Antikainen, M., Aminoff, A., Kettunen, O., Sundqvist-Andberg, H., & Paloheimo, H.	2017	Circular economy business model innovation process - Case study
2	Bocken, N., Strupeit, L., Whalen, K., & Nußholz, J.	2019	A review and evaluation of circular business model innovation tools

3	Brown, P., Bocken, N., & Balkenende, R.	2019	Why do companies pursue collaborative circular oriented innovation?
4	Guzzo, D., Trevisan, A. H., Echeveste, M., & Costa, J. M. H.	2019	Circular innovation framework: Verifying conceptual to practical decisions in sustainability-oriented product-service system cases.
5	Lewandowski, M.	2016	Designing the business models for circular economy -- Towards the conceptual framework.
6	Marouli, C.	2016	Moving towards a Circular Economy: The Need to Educate - Why and How
7	Wandl, A., Balz, V., Qu, L., Furlan, C., Arciniegas, G., & Hackauf, U.	2019	The circular economy concept in design education: Enhancing understanding and innovation by means of situated learning
8	Wastling, T., Charnley, F., & Moreno, M.	2018	Design for circular behaviour: considering users in a circular economy

Insights What can we tell from the existing work on CE?

CE are cross-organisational and mostly cross-border challenges. A single person cannot transform a complete value chain of an industry, nor one company. Nevertheless, education programs are mostly designed for individuals in groups. Brown et al. (2019) state that employees who are enthusiastic about CE and have the ambition to become CE front-runners driving the co-creation of the problem and solution space. They develop insights, best practices, and guidance through fast-cycle collaborative

Graphic 1. Circular Innovation Framework



Circular strategies description	
<p>Inner Circles Strategies for enhanced level of use and consumption of products</p> <ul style="list-style-type: none"> a1 Encourage reducing end-user consumption a2 Enable shared use or ownership of products among members of a community a3 Provide the functionality or the result of the product use, while retaining ownership a4 Sell access to a product for a specific period or use cycles, while retaining ownership a5 Knowledge-based services to increase the level of use of products 	<p>Circling Longer Strategies for enhanced lifetime of products, parts and components</p> <ul style="list-style-type: none"> b1 Knowledge-based services to increase the lifetime of products or components b2 Provide spare and consumable parts while keeping longer lifecycle parts b3 Provide or facilitate failure prediction, maintenance or repair services b4 Upgrade system while keeping functional products' subsystems or components b5 Facilitate sales, return or collection of used units of functional products or components b6 Provide reconditioning, refurbishing, or remanufacturing services b7 Manufacture products or components with an optimal lifespan
<p>Pure Inputs Strategies to enhance the application of materials and energy</p> <ul style="list-style-type: none"> d1 Use of renewable energy for products and components manufacturing and functioning d2 Use of fewer resources for products and components manufacturing and functioning d3 Use of bio-based input material for products or components production d4 Use of fully recyclable input material for products or components production d5 Provide the function of products and services through virtual or disruptive manners 	<p>Cascade Use Strategies to recover discarded materials and energy</p> <ul style="list-style-type: none"> c1 Use of a process' by-products as input to another process c2 Facilitate sales, return or collection of discarded material c3 Recover resources out of discarded material through recycling, upcycling, downcycling, or biodegradation c4 Recover energy out of discarded material through heat, electricity or fuel source

Source: Guzzo et al. 2019

experimentation and the validation of underlying assumptions. To be able to master the CE transformation successfully, they demand a collaborative corporate culture that promotes and demands entrepreneurially minded leadership, motivated by enthusiasm, and crucially, a credible approach to CE. Those leaders develop Circular Innovators.

How can leaders and employees engaged in a circular business take decisions in product-service systems circular innovation? Guzzo et al.(2019) raised this question and developed a CI framework based on a systematic literature review. The framework contains twenty-one circular strategies supporting tactical decisions when developing circular product service solutions and is shown in Graphic 1. The tool may well be able to support the business model development process (see Graphic 1).

Marouli (2016) describes in her guidelines for CE Education how students in the university environment can approach the CE organisational environment. The guidelines propose instruments and methods that could be used in CIN training. The researcher speaks of systemic thinking, critical knowledge capacity, collaborative skills, and socio-political literacy. For educators to effectively deal with the new challenges, integration, collaboration, as well as systemic and circular thinking should become central in teachers, university professors, and engineers (see Table 3). She suggests a variety of interactive and practice-oriented application exercises to develop a critical and open mindset in the learners that guides their proactive actions.

Table 3. Circular Economy Education Design Guidelines

<i>Teaching/ Learning purpose</i>	<i>Character- istics/ Skills targeted</i>	<i>Learning context/ Teaching methods</i>	<i>Instructional tools</i>	<i>Key outcomes</i>
<i>For individual change, critical learners</i>	<ul style="list-style-type: none"> • Critical thinking • Creativity & innovation • Knowledge creation 	<ul style="list-style-type: none"> • Case study analysis • Dialogic class • Problem analysis • Class as a democratic forum 	<ul style="list-style-type: none"> • Case studies • Audio visual materials • Role playing • (Guided) laboratory activities 	<ul style="list-style-type: none"> • Critical knowledge • Analytic ability • Synthetic ability

<p><i>For empowerment, empowered learners</i></p>	<ul style="list-style-type: none"> • Real problem solving • Desire to act on knowledge • Sense that you can cause individual and social change • Political literacy • Systems thinking 	<ul style="list-style-type: none"> • Real life problem solving • Investigating connection of individual issues and social problems (personal is political) • Service learning • Experimental learning (learning concepts by doing) • Class as a think tank 	<ul style="list-style-type: none"> • Projects on problems, questions seeking answers • Group activities in class and outside experiments • Field work • Work in an NGO • Internet searches – use of knowledge data base 	<ul style="list-style-type: none"> • Problem solving • Systems thinking • Research ability
<p><i>For integration, critical and engaged citizen</i></p>	<ul style="list-style-type: none"> • Integration of different bodies of knowledge • Integration of experience & knowledge; of diverse sources of knowledge • Circular logic • Local and global connections 	<ul style="list-style-type: none"> • Integrative projects, requiring diverse sources • Multicultural exchanges • Investigation of end-of-life uses • Multi-scalar analysis • Class as a research group 	<ul style="list-style-type: none"> • Group projects & in class group activities • Different groups – on different aspects of a multi-faceted problem • Local / international problems • Social media / web-based tools • Use of synchronous and asynchronous internet-based tools 	<ul style="list-style-type: none"> • Holistic – circular – transdisciplinary thinking • Connection and relations • Communication • ICT skills

<i>For social transformation, empowered citizens</i>	<ul style="list-style-type: none"> • Understanding socio-political, economic, and cultural context / dynamics • Collective action, social responsibility & participation in community affairs 	<ul style="list-style-type: none"> • Action research (local problem, investigation, collaboration with community, problem solving, policy implications) • Connection with society • Democratic decision making in class 	<ul style="list-style-type: none"> • Group work – working on a local problem/use • Collaboration with local community and other experts • People research • Online tools (ICT) – for connectivity 	<ul style="list-style-type: none"> • Social responsibility • Socio-political savvy • Action research capabilities
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Source: Marouli 2016

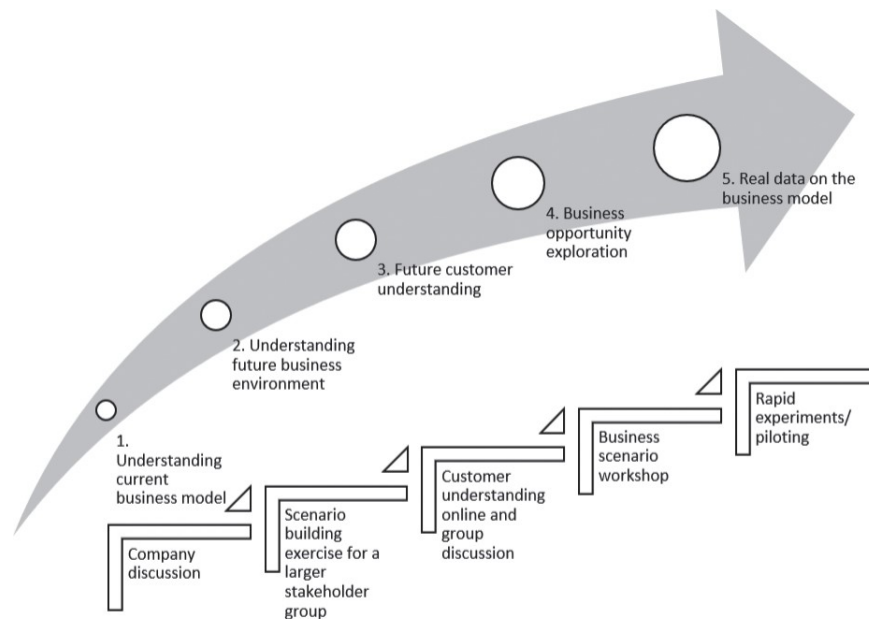
To develop systemic thinking, researchers have already started to introduce research and design practices in the CE context and have had positive experiences with it. Wandl et al. (2019) propose a living lab approach in which students in a small group start with objectives formulated by real stakeholders and presentations to the stakeholders during workshops. They create their solutions coached by mentors. Integrating the CE concept into teaching gives the students more speed to take on a systemic perspective and relate local problems of the linear economy within the broader spatial system. Nevertheless, the integration of research and education is staff-intense because a higher teacher-to-student-ratio is required, which universities can rarely provide. Moreover, transparency for students is essential regarding the ways of working and the staff background supporting them.

Wastling et al. (2018) propose to change the design of the business model towards CE. This can happen once in a way that an existing business model is changed towards CE. In this case, Antikainen et al. (2017) offer a process guiding innovators in doing so. Alternatively, a CE business model is rebuilt, then Lewandowski's (2016) Circular Business Model Canvas can be used.

Circular business models are defined as 'a business model in which the conceptual logic for value creation is based on utilising the economic value

retained in products after use in the production of new offerings' (Linder & Williander 2017). To develop circular business model innovations from existing business models, Antikainen et al. (2017) propose a five-step process shown in the following graphic 2.

Graphic 2. Circular Business Model Innovation Process



Source: Antikainen et al. (2017)

The process starts with a discussion in which the existing business model is discussed. Building on this, new business models are jointly developed for the companies in a stakeholder group. Next, group discussions are used to understand consumer needs and to develop business scenarios in a workshop. In a final step, the newly developed CE business models are tested using quick experiments and pilots which are then evaluated using market data. Brown et al. (2019) describe the process approach as a tool to develop, design, and test or implement ideas. They developed the approach with three company cases and consumer involvement and then tested it with a more complex pilot.

In order to understand how new circular business models (CBM) can be developed, Lewandowski (2016) extends the nine-dimensional Business Model Canvas developed by Osterwalder & Pigneur (2010) and others (Osterwalder et al. 2014). The researcher adds two additional dimensions,

a take-back system and adoption factors to a circular business model. The take-back system focuses on the reclamation of resources, while the adoption factors are supportive measures, such as external factors that lead to the CBM (see Table 4).

Table 4. Circular Business Model Canvas

<i>Partners</i> <ul style="list-style-type: none"> • Cooperative networks • Types of collaboration 	<i>Activities</i> <ul style="list-style-type: none"> • Optimising performance • Product design • Lobbying • Remanufacturing, recycling • Technology exchange 	<i>Value Proposition</i> <ul style="list-style-type: none"> • Product service system • Circular product • Virtual service • Incentives for customers take-back system 	<i>Customer Relations</i> <ul style="list-style-type: none"> • Produce on order • Customer vote (design) • Social-marketing strategies and relationships with community partners in recycling 2.0 	<i>Customer Segments</i> <ul style="list-style-type: none"> • Customer types
	<ul style="list-style-type: none"> • Key Resources • Better-performing materials • Regeneration and restoring of natural capital • Virtualization of materials • Retrieved resources (products, components, materials) 		<i>Channels</i> <ul style="list-style-type: none"> • Virtualization 	
<i>Cost Structure</i> <ul style="list-style-type: none"> • Evaluation criteria • Value of incentives for customers 			<ul style="list-style-type: none"> • Revenue Streams • Input-based • Availability-based • Usage-based • Performance-based • Value of retrieved resources 	
<i>Adoption Factors</i> Organisational capabilities PEST factors				

The value proposition incorporates circular products enabling the product-life extension, product-service system, virtualised services, and/or collaborative consumption. Customer segments in a circular business model are directly linked with the value proposition component. The selling predominantly occurs virtually via social media such as online communities. Customer relationships underlie production on order and/or customer decisions. Payments for a circular product or service, such as usage, generate revenues. The revenues are connected to the materials retrieved from material loops. Essential resources are suppliers offering better-performing materials, virtualisation of materials, resources allowing regeneration and restoration of natural capital, and/or the resources obtained from customers or third parties meant to circulate in material loops (preferably closed). As critical activities, the author highlights performance improvements through good housekeeping, better process control, equipment modification, technology changes, sharing and virtualisation, and design improvements to create more eco-friendly solutions. Key activities might also comprise lobbying. Within the circular economy, companies partner along the value chain. Costs mainly include marketing expenditures and materials.

In Bocken et al. (2019) thirteen analysis tools are presented that are relevant to CE which were building on insights from literature and practice, that have been validated in practice which has been documented, and that propose a procedure so that others can use them. The tools are presented in the following Table 5.

Table 5. Shortlisted publications from Bocken et al. (2019, 6-7)

<i>No.</i>	<i>Authors</i>	<i>Year</i>	<i>Title</i>
1	Antikainen M., Aminoff A., Kettunen O., Sundqvist-Andberg H., Paloheimo H	2017	Circular economy business model innovation process – case study
2	Bocken N., Miller K., Evans, S.	2016	Assessing, the environmental impact of new circular business models

3	Evans S. and Bocken N.	2014	A tool for manufacturers to find opportunity in the circular economy
4	Haines-Gadd M., Chapman J., Lloyd P., Mason, J., Aliakseyeu, D.	2018	Emotional durability design nine – a tool for product longevity
5	Heyes G., Sharmina M., Mendoza J.M.F., Gallego-Schmid A., Azapagic A.	2018	Developing and implementing circular economy business models in service-oriented technology companies
6	Leising E., Quist J., Bocken N.	2018	Circular economy in the building sector: three cases and a collaboration tool
7	Manninen K., Koskela S., Antikainen R., Bocken N., Dahlbo H., Aminoff A.	2018	Do circular economy business models capture intended environmental value propositions?
8	Mendoza J.M.F., Sharmina M., Gallego-Schmid A., Heyes G., Azapagic A.	2017	Integrating backcasting and eco-design for the circular economy: The BECE framework
9	Nußholz J.L.K.	2018	A circular business model mapping tool for creating value from prolonged product lifetime and closed material loops
10	Pigosso D.C.A., Schmiegelow, A., Andersen M.M.	2018	Measuring the readiness of SMES for eco-innovation and industrial symbiosis: development of a screening tool

11	Sinclair M., Sheldrick L.; Moreno M., Dewberry E.	2018	Consumer intervention mapping: a tool for designing future product strategies within circular product service systems
12	Whalen K., Berlin C., Ekberg J., Barletta I., Hammersberg P.	2018	Lessons learned from the use of serious game for circular economy education
13	Whalen, K.	2017	Risk and race: creation of a finance-focused circular economy serious game

If you would like to learn more about the analysis tools just presented, you can look up the corresponding source online. The CI Education Program would have to be checked in detail as to which of the tools are particularly suitable. Due to the keyword search that is related to CI and education, there is only one overlap in this paper concerning the analysis of Bocken et al. (2019) and this is the process approach by Antikainen et al. (2017).

The findings from the analysis of the eight highly relevant publications can be summarised as follows. A circular innovator needs a confident attitude as a prerequisite to be effective. According to Brown et al. (2019), necessary attitudes are being enthusiastic about CE and having the ambition to become a CE front runner. If this attitude is adopted, appropriate skills can be developed with the help of interactive project-based learning. Effective behaviours such as driving co-creation of the problem and solution space or developing insights, as well as best practices within fast-cycle collaborative experimentation (Westling et al., 2019) could be developed in a living lab, as presented by Wandl et al. (2019). Systems and critical thinking (circular logic, cause-effect on social change) could evolve through real problem-solving in case studies with local or global partners. Creativity and innovation could be developed with role plays, group activities, audio-visuals, and internet-based tools. Collaboration with local communities as well as group work builds collaboration skills. Fieldwork in NGOs sponsor artificial knowledge

capacity (act on knowledge, integrate different bodies of knowledge, integrate diverse sources) and socio-political literacy (understanding socio-political, economic, and cultural context/dynamics). Building and testing hypotheses can occur as part of internet searches, laboratory activities, and action research (Marouli 2016). Once the skills have been developed, CI tools can help with decision-making, such as the CI Framework from Guzzo et al. (2019).

Now the focus is on existing CE projects, some of which were also mentioned in the previously mentioned papers. At the European level, a comprehensive approach has invested enormous sums in the development of CE training courses and innovations since 2016.

Europe

Between 2014 and 2020, the European Union called out for 124 circular economy projects (EC Europe 2021). The circular cities and regions initiative is also part of the new circular economy action plan. It will implement circular solutions at a local and regional scale and help deliver on the European Green Deal and the EU bio-economy strategy (European Commission 2021).

Within the Horizon program, research funded by the European Union, the EIT RawMaterials and EIT Climate-KIC community are working on CE initiatives. Both communities are contributing to our system change by reshaping European policy, orchestrating all actors, producing thought leadership on CE transition, developing scientific methodologies for participatory engagement etc. (EIT RawMaterials 2021; EIT Climate-KIC 2021).

United Kingdom

The Allen McArthur Foundation published a report on circular cities in 2019, which focuses on minimising waste and pollution in cities, maintaining materials from products, and regenerating natural systems (EllenMcArthur Foundation 2021a). Moreover, the foundation created an approach to measure circularity (EllenMcArthur Foundation 2021b).

Germany

The Circular Economy Initiative Germany (2021) defines goals for this change process and focuses on the following topics:

1. Circular business models and digital technologies as drivers of innovation
2. New value networks for batteries and packaging
3. Framework conditions for a circular transformation and measurement of the economic circular economy potential

In addition, the project aims to initiate the development of the first pilot projects. The actors would like to contribute to setting up concrete activities in research and development to promote or implement relevant technologies, functional systems, or materials.

What research directions could we take?

The Circular Innovator Education Program's importance can be proven. A cross-company survey should provide information about the percentage of employees in a company, country, or region that are Circular Innovators. In order to then set-up and test a CI blended learning approach. To do this, a survey with educators in Europe who are familiar with the topic and identify knowledge, skills, and competencies needed to build a strong CI culture, ecosystem, and performance system. Global research on existing university programs going into the CI direction should be conducted, and partnerships developed to research the topic jointly. Three different training programs are to be developed together with experts tried out experimentally in different user groups and followed over several years to see what training effect they have on an individual and organisational level.

What conclusions can we take away?

CE is a hot topic that should be integrated into academic, school, and professional training as soon as possible. CE innovators are enthusiastic about CE, follow a moral compass and have the ambition to become CE front-runners. In addition to the innovators who develop this innovation, their leaders should also be selected or trained to exemplify a responsible entrepreneurial mindset and contribute to building a collaborative culture of experimentation.

When developing a CI Education Program, existing knowledge can be built on. A wide range of instruments, models, and methods was presented, and guidelines on how the CE way of thinking can be trained using interactive learning forms. The first challenge is to find people who want to promote CE *and* who want to create circular innovations. The second challenge is to train them in the skills they need to become effective. Placing them in an organisation that is willing and able to transform into a circular business is the third challenge. The final challenge is to commercialise circular innovations with a business model that meets the market demand and speaks a language that CE consumers understand. The next step will be to discuss the CI Program in the context of responsibility as a human being, as a citizen, as an innovator, as a leader, and as an educator.