



Curricular Framework

for

Advancing Circular Economy

Age 11 to 14 Years



Supported by



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Advancing Circular Economy

Age 11 to 14 Years

A guide for Teachers, Educational Material Developers, and Education for Sustainable Development Programme Managers.

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Foreword

It inspires me to know that there are people around the world—in multiple disciplines—working to redesign the way we buy, use, and reuse the stuff of our lives. They reject the inevitability of depleting the planet’s finite natural resources every time we create something—from cars to carpets to computers to clothes—and leaving behind waste and toxicity when we dump it or burn it. Instead, they encourage a circular way of thinking—where we design longer-lasting projects, repair and reuse as much as we can, and remanufacture and recycle to save resources, reduce waste, and reduce costs. But how to put this into effect? Pramod Kumar Sharma and Kristina Madsen show us a way forward. Their curricular framework is a great step in identifying the concepts that will help our students think critically about how to create a more sustainable economy.

With this framework in hand, the next generation will lead the way in transitioning from a linear economy to a circular economy and reducing our dependence on finite resources to create greater economic, social, and environmental resilience and health. I also hope that this pilot and the lessons we learn demonstrate how vital economic education is to our efforts to create an environmentally and civically engaged global society. We need global citizens who understand the circular economy and have the knowledge, skills, and motivation to support innovative and fair economic systems that protect the environment and advance community well-being and shared prosperity.

Judy Braus

Executive Director
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Preface

Circular Economy as a perspective is inspired by the natural world where there is no concept of waste. Everything in the natural world is a resource for the next level or step in the cycle of interdependence. This framework is an attempt to capture the concepts of circular economy and present them to the stakeholders in the school system to develop the literacy that will help in advancing circular economy. A circular economy is an integrative concept that brings together many literacy outcomes that are already being facilitated by Education for Sustainable Development (ESD) through its focus on different environmental issues and quality education. The idea is not to create a new set of learning outcomes but through this document analyse, collate, and facilitate learning outcomes that support our transition to a circular economy.

We have used the word ‘advance’ as we believe that all of us, as global citizens and consumers, play an important role in any transition. As citizens, we can influence our socio-political systems to agree on the need for changing the current production and consumption systems and put in place frameworks that support the transition. As consumers, by our choices, we can support corporations that produce products and services that promote principles of a circular economy. The transition requires that we not only look at managing problems downstream, but also focus on solutions upstream in the production and consumption systems by reimagining the design of the products and materials used to eliminate waste.

The framework presented is intended to support curricular developers in integrating the concepts into our teaching, including in the educational standards that guide the curriculum and in the content we use to engage educators and students in the classroom and beyond. The framework is not an exhaustive document and will evolve as we get more experiences and understanding of how educators are creating effective and engaging lesson plans and ideas to bring the circular economy concepts to classrooms. These learning outcomes are designed to be achieved over three years and should build on each other to help students understand how circular economy can help support a more sustainable future.

Please feel free to share your feedback and inputs that will help us shape the next edition of the framework.

Pramod Kumar Sharma
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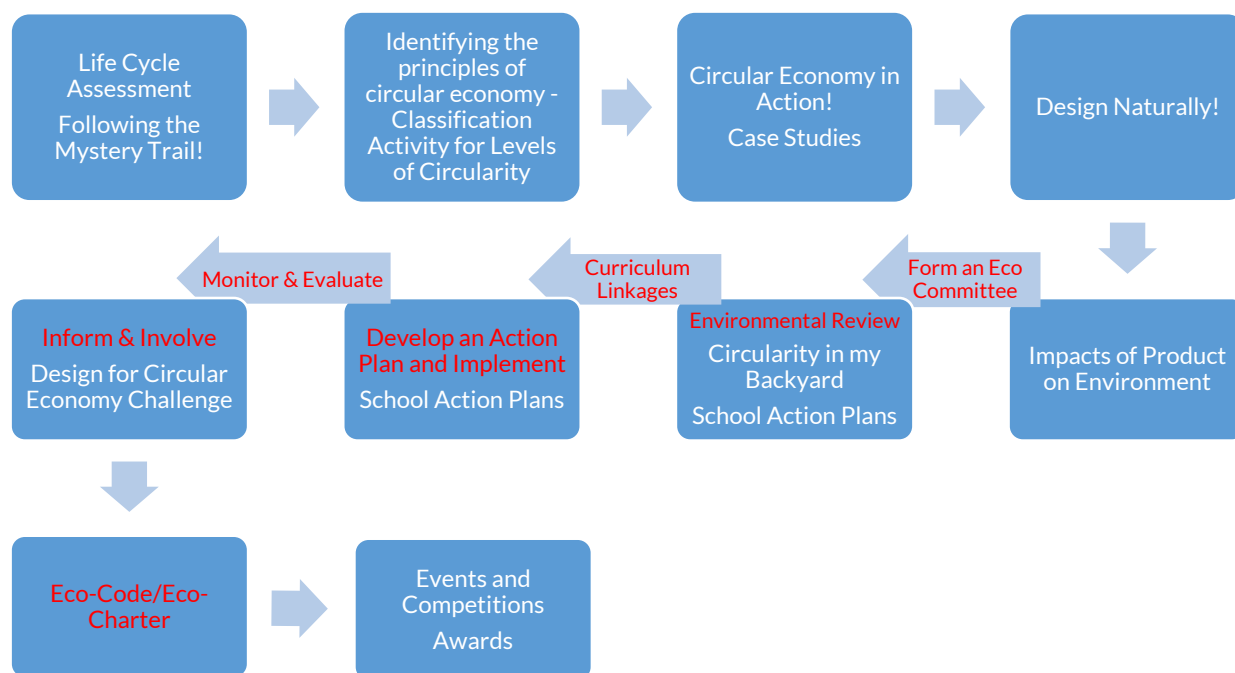
Background to E-SPACE project

Eco-Schools Project for Advancing Circular Economy (E-SPACE) is a pilot being implemented in the Eco-Schools of Slovenia and Latvia with support from Lucart Professional. The two-year project pilots a methodology designed to prepare the younger generation with the knowledge of circular economy and empower them to take actions for advancing it.

This pilot focuses on developing a 'whole school' programme that builds knowledge and critical thinking skills in the age range of 11-14 to advance the principles of a circular economy and how to create new economic models that reduce waste and leads to the achievement of SDG 12 to ensure sustainable consumption and production patterns.

Eco-Schools' Seven Steps methodology provides an opportunity to learn about circular economy and take action. The learning journey starts with a basic understanding of how products and services are produced, how our production systems impact sustainability, and how our current consumer and waste disposal systems are unsustainable. It also focuses on new ways to promote sustainable production and consumption systems and how we can learn from nature and build systems that are circular with limited waste. Students are encouraged to work on an action project that looks at common streams of products such as electronics, paper, food and services like transport in their Eco-Schools and redesign these streams to increase circularity and reduce environmental impact. The project is also designed to develop the skills and motivation to help them facilitate change in their sphere of influence.

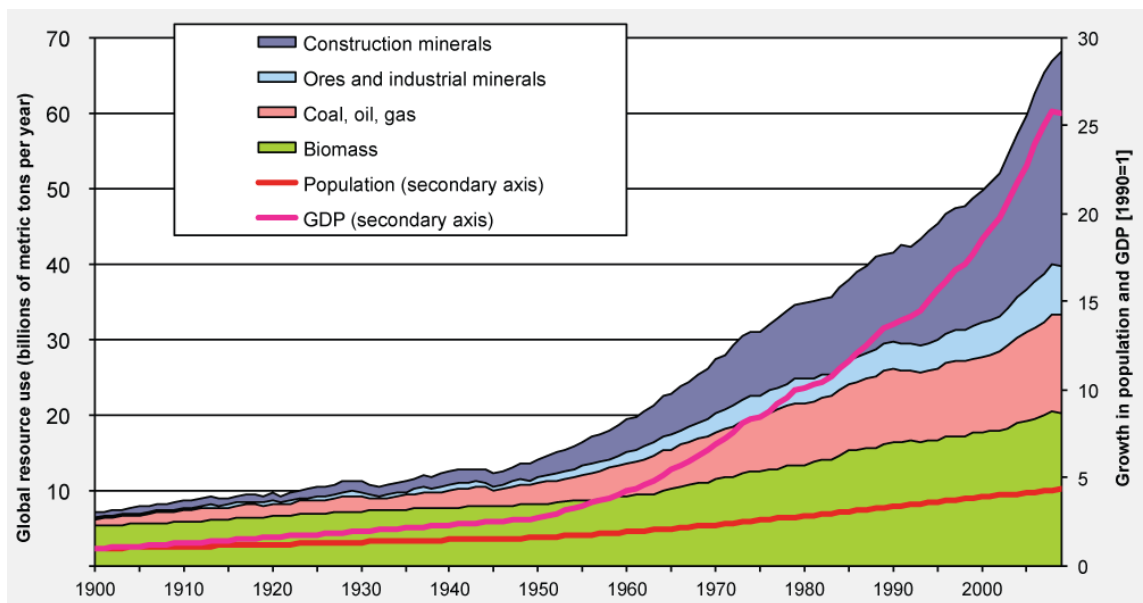
The educational process in E-SPACE:



Linear Versus Circular Economy

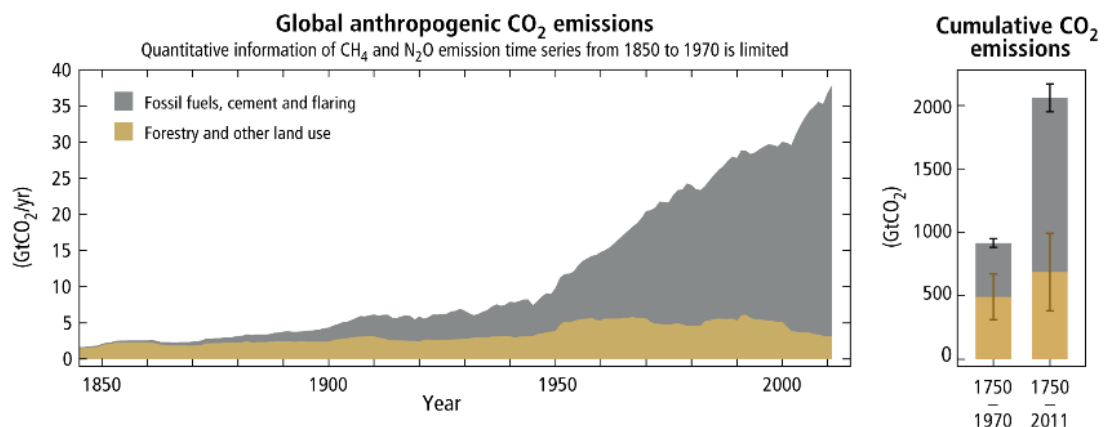
Circular Economy is a sustainable production and consumption perspective that has its origin in the realisation of sustainability challenges that we are facing due to the linear model of extract/take- produce/make -consume/use - dispose/throw. The linear economic model has grown exponentially with the growth of services and hyper-consumerism. The invisible subsidies, by not accounting economic, social, and environmental costs, make the costs of goods seem very low, fuelling unnecessary consumption and waste. The inefficiencies and significant environmental costs of the linear model are being better recognised due to the following main reasons:

- Ecological degradation** due to the increasing extraction of resources to meet the increasing demands of growing populations. The degradation is compounded by the waste that is accumulating in our natural systems. The affluence to pay and consume more and the technological advancement enabling large scale extraction are two primary reasons for unsustainable consumption.



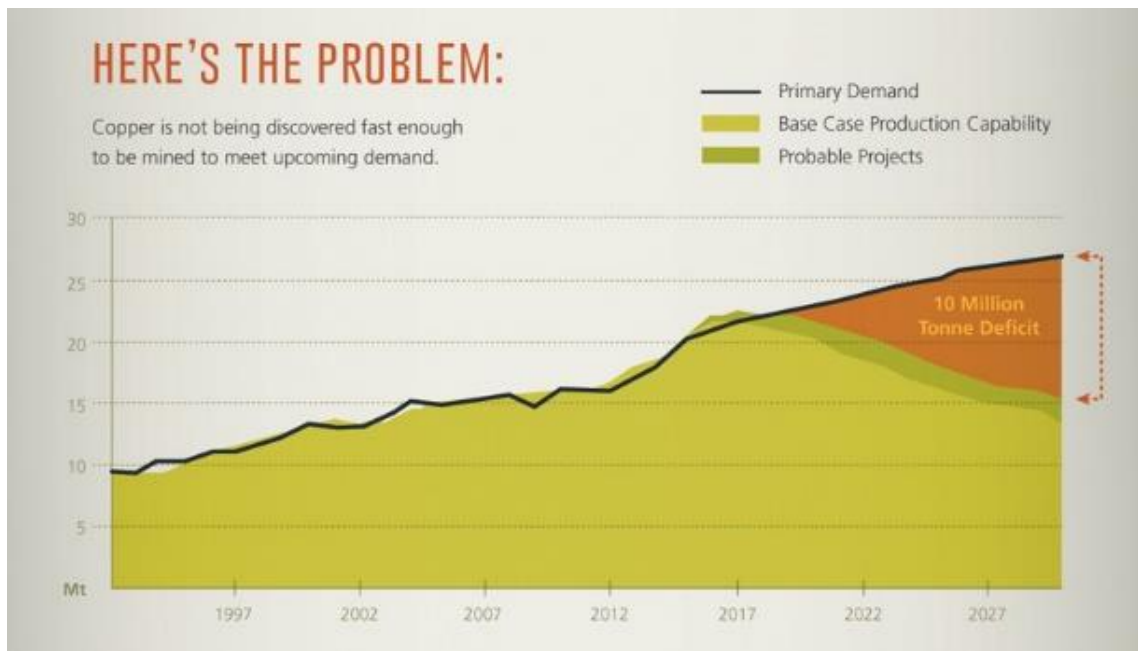
Source – International Geosphere –Biosphere Programme

- Carbon-intensive production, supply, and consumption systems** are based on fossil fuels as a primary source of energy. The increasing carbon in the atmosphere has created the problem of global warming and climate change.



Source - IPCC Fifth Assessment Report

- **Scarcity of virgin resources** that forms the basis of the production systems of goods and services. A declining number of mines have also increased the use of more resources for extracting and maintaining the supply of the raw materials, in the process, increasing carbon emissions.



Source - <https://www.visualcapitalist.com/the-looming-copper-supply-crunch/>

Key Characteristics of Circular Economy

We live in a paradox - the industrial revolution has helped raise the level of comforts and quality of life, but in the process, we have created systems that are heavily dependent on the use of energy and other resources to produce and deliver products and services. The extraction of energy and other resources has degraded the nature of which we are a part and on which we are dependent to meet our everyday needs. The environmental challenges that have developed over a very short time of our existence on Earth are forcing us to critically look at alternatives in form of sustainability ideas. Circular Economy as an idea is inspired by nature, which is a regenerative system - it renews, restores, and grows on its own with no judgment of what materials are “waste”; materials are simply considered for their intrinsic value.

The natural systems provide a framework for the paradigm shift to design our production and consumption (economic) systems to restore natural capital to the biosphere and utilise materials used to make our products in cycles. It requires a system that generates ‘resources’ and not ‘waste’ during the life cycle of a product or a service. This is achieved by rethinking the ‘take-make-dispose’ consumption patterns and establishing restorative and regenerative system by innovation and redesigning of our economy. In a circular economy, the system is powered by energy renewable by nature, to enhance its resilience and resource independence. Naturally, the use of toxic chemicals is eliminated. Thanks to

a circular design, aiming for optimized cycling within the system, waste is designed out. (Ellen MacArthur Foundation 2015).

The main principles of circular economy correspond to the principles of spaceman economy introduced by Boulding in which Earth has become a single spaceship, without unlimited reservoirs of anything, either for the extraction or for pollution, and in which, therefore, man must find his place in a cyclical ecological system which is capable of continuous reproduction of material form even though it cannot escape having inputs of energy.

Although the circular economy framework combines several schools, philosophies and principles, it is essentially based on three main principles:

a) “designing out” waste or simply reworking the systems to not produce waste. This is achieved by the design of product or services that are durable, uses recyclable material, and are repairable.

b) separating the biological (residual, often organic, resources that are non-toxic and can be safely returned to the biosphere like paper and wood) from technical (unsuitable for biosphere systems like metals and plastics) materials where the former are returned to the biosphere, and the latter are reused indefinitely. This requires our participation for example in the segregation of waste at home and composting green waste and putting other waste for recycling.

c) using renewable energy to decrease dependence on coal and other fossil fuels and reduce loss and vulnerabilities to failure by producing locally.

Circular Economy is an integrative idea that synthesises several sustainability perspectives built on the set of three basic principles mentioned above. Some of the perspectives are:

1. Biomimetics or Biomimicry - An approach to learn from the patterns and strategies of nature to find solutions to meet our needs and challenges. In the context of sustainability, the aim is to create products, processes, and policies that are in harmony with life on Earth over the long haul. The core idea is that nature has already solved many of the problems we are dealing with. Animals, plants, and microbes are the consummate engineers. After billions of years of research and development, failures are fossils, and what surrounds us is the secret to survival.

2. Cradle to Cradle - Also called Regenerative Design imitates cyclic natural systems with outputs as input for every step of the process. The approach challenges the current Cradle (resource) to Grave (landfill) production and consumption approach and suggests that industry must protect and enrich ecosystems and nature's biological flow while also maintaining a safe,

productive, technical flow for high-quality use and circulation of organic and technical nutrients or simply materials.

3. Performance Economy - A “closed-loop” approach to production processes that pursues goals of product-life extension, long-life goods, reconditioning activities (remanufacturing, refurbishing, and repair) and waste prevention. It also insists on the importance of selling services like car hiring rather than buying cars – reducing the number of cars required to service transport needs and hence the materials required to produce cars reduce considerably.

4. Industrial Ecology - Industrial ecology is the study of material and energy flows through industrial systems. Focusing on connections between operators within the ‘industrial ecosystem’, this approach aims at creating closed-loop processes in which waste from one industry or process serves as an input for another, thus eliminating the notion of an undesirable by-product. This framework is sometimes referred to as the ‘science of sustainability’, given its interdisciplinary nature, and its principles can also be applied in the services sector. With an emphasis on natural capital restoration, industrial ecology also focuses on social wellbeing.

5. Natural Capitalism - “Natural capital” refers to the world’s stocks of natural assets including soil, air, water (Abiotic resources), and all living things (Biotic resources or biodiversity). It is a global economy in which business and environmental interests overlap, recognising the interdependencies that exist between the production and use of human-made capital and flows of natural capital. The concept of natural capitalism is based on the principles of radically increasing the productivity of natural resources, shift to biologically inspired production models and materials with no concept of waste by modelling closed-loop systems on nature’s cyclic designs where every output is either returned harmlessly to the ecosystem as a nutrient or becomes an input for next step in the process/flow.

Role of Education in Advancing Circular Economy

"We cannot solve our problems with the same thinking that created them." - Albert Einstein

The core purpose of education is to help empower young people with the knowledge, skills, and motivation to be active and engaged global citizens, working to creating healthier and more equitable and resilient communities. Education for Sustainable Development (ESD) provides the individual with:

- skills to strike a balance between social and economic well-being that respects diversity and protection of the environment and resources.
- values of solidarity, equality and solidarity, social harmony and mutual respect for all.

ESD facilitates new ways to think about economic progress. It shapes and strengthens the ability of all learners to think critically and understand how environmental integrity is linked to community well-being and shared prosperity. It is an interdisciplinary approach to using the power of education to create a safer, healthier, and more prosperous world, thereby improving the quality of life.

Circular Economy Literacy in the context of the E-SPACE project is the development of knowledge, values, attitudes/disposition, and behaviours in form of positive action that puts the goal for moving towards "zero waste" as a key outcome using the principles and strategies of a circular economy. The literacy should motivate a person with competence to reduce the loss of material and energy at every stage of production and consumption.

Many will argue that the transition to circular economy systems is more of a responsibility of industries that must be driven by governmental policy. However, individuals as consumers/buyers and also as citizens are an important driver to motivate the industry and governments to fasten the rate of transition. Active citizenship, as an important outcome of ESD, also motivates governments to frame and implement policies that support this transition.

The entry point to Circular Economy Education can be through any existing environmental education initiative likes energy conservation, waste management, biodiversity education, climate change etc.

In practice, ESD in the context for Circular Economy:

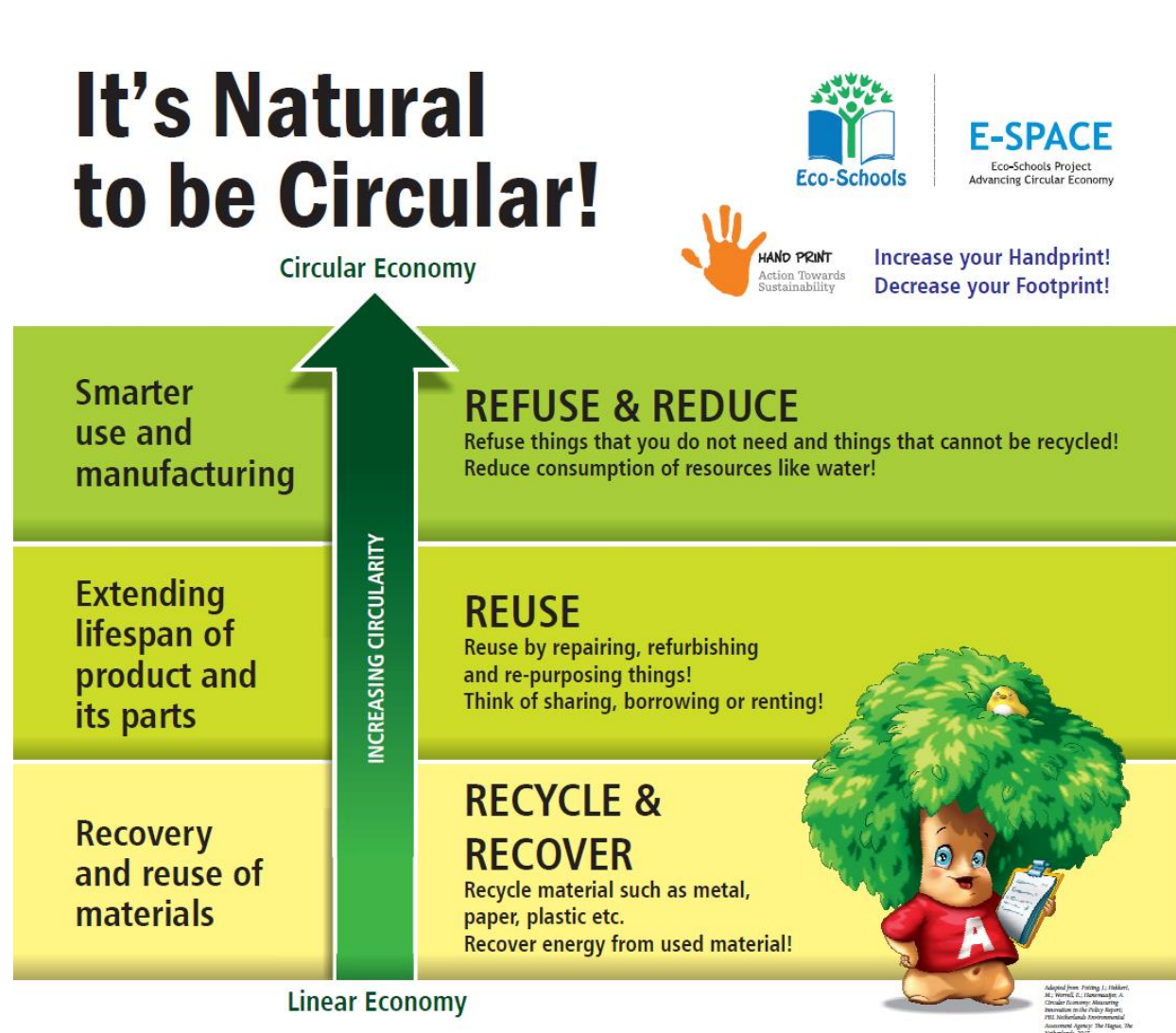
- enables a learner to acquire literacy in the form of knowledge, skills/competencies, attitudes, and values to take positive actions to reduce waste.
- is focused on not accepting the status quo and develop the agency for problem-solving by increasing circularity using different strategies.
- is equally accessible at all levels and involves all family, school, workplace, and local community.
- builds active citizenship to assert individuals' rights and responsibilities in a democratic setup to have choices like right to repair.

- is based on the principle of lifelong learning as we understand the issues better and participate in making the world better with new initiatives.
- uses a variety of educational methods, seeking creative ways to express disruptive ideas based on design thinking.
- promotes action at the local level for global issues.

Circular Economy Competencies

- Systems Thinking
- Life Cycle Analysis and Understanding
- Eco-Design Thinking
- Multidisciplinary Knowledge
- Business Ethics
- Negotiation Skills
- Principles of Social Entrepreneurship

The Education for Advancing Circular Economy motivates an individual to take decisions as per the following matrix:



Curricular Framework - Education for Advancing Circular Economy

In the framework below, the intention has been to list the learning outcomes in a hierarchical order, meaning that they build on each other. However, the order may be adapted depending on the user and the respective learners.

Thematic Area	Key Concepts/Big Ideas	Specific Learning Outcomes
Cycles or Circular Flow of Resources	Cycles in nature Bio/Physical Resources – material and energy Linear economy flow: ‘take-make-consume and dispose of’ Recycling Circular Flow – Learning from nature to develop cyclic loops of material and energy Principles of thermodynamics	<p>Students are able to:</p> <ul style="list-style-type: none"> • illustrate cycles in nature, such as water, carbon, and nitrogen cycles. • identify the energy and material flow in different cycles of nature. • compare the flow of resources in natural systems with human-made systems. • relate the lack of waste in nature to the circular flow of organic and inorganic materials or natural cycles aided by processes like decomposition. • identify/list resources that are used to develop commonly used products and services that we consume in our daily life. • map the flow of resources used to make many common products. • identify the components of a linear economic system and examples of how this impacts production and waste. • conclude that most of the current system of production and consumption happens in a linear flow. • explain the linear flow with examples of products from daily life. • distinguish linear flow from circular flow. • compare the similarities and differences between a linear and circular production process. • list advantages of circular flow. • explain the circular flow with examples from daily life. • realise that the problem of waste in human societies is due to linear flow systems of production and consumption. • defend that circular flow is one of the important strategies to enable long-term resilience, secure sustainable resource supply and the well-being of the planet. • critique the linear economy.

		<ul style="list-style-type: none"> infer that any system will have a loss due to the laws of thermodynamics and that energy is a critical input. begin to investigate a circular economy as an alternative model to the linear economy.
Circular Economy	<p>Key concepts to understand the need for Circular Economy:</p> <ul style="list-style-type: none"> - Linear economy - Resources – technical and biological - Critical raw materials - Embedded value - Increased efficiency by eliminating waste, rebuilding natural capital, creating additional value - Regenerative and restorative systems 	<p>Students are able to:</p> <ul style="list-style-type: none"> define key terms, such as Linear Economy, Circular Economy, Technical Nutrients, Biological Nutrients, System, Biosphere, Regenerative, Restorative. distinguish between a technical and biological resource or a brown and green resource. disprove the assumption that ‘resources are abundantly available, easy to source and cheap to dispose of’. identify the urgent challenge that finite resources and increasing consumption pose. illustrate the journey of a commonly used product like paper in terms of resource use and waste generated at each step of its production (Life Cycle Analysis using Systems Thinking). identify Used (technical nutrients) and Consumed (biological nutrients) in commonly used products/services. list the advantages and disadvantages of a circular economy versus linear economy. explain the causes of waste in current economic systems and the impact of waste on the environment, social well-being, and economic prosperity. explore the economic history since the industrial revolution through a personal narrative. critically evaluate our current consumption and production systems and explore better ways of dealing with resources. argue why a solution around resource constraints makes economic sense. realise that some of the solutions to waste management, such as burning waste to produce energy, fails to consider the high material value of waste or the hazardous impacts of burning them for cheap fuel. critique incineration or burning as a disincentive for material reuse as it promotes throwing away exhaustible raw materials, along with the energy needed to

		<p>mine natural resources and manufacture them into consumable products.</p> <ul style="list-style-type: none"> • distinguish between the two approaches of sustainability: down-cycling (converting valuable products into low-value raw materials) and up-cycling (converting low-value materials into high-value products). • appreciate that all pre-industrial production systems were based on the circular economy - from buildings made of local materials to biodegradable clothing and clay/metal cooking pots. • conclude that circular economy is a simple integrative concept in which redundant consumer goods are viewed as input rather than waste – and that it offers great potential for societies to reduce their environmental footprint and increase their positive handprint. • list the benefits of a thrust of Circular Economy as restoration of natural resources, shifts towards the use of renewable energy, it removes the use of toxic chemicals, promotes the superior design of materials, products, systems. • identify critical elements or critical raw elements and sources. • give some examples of some of critical raw materials. Some examples: (Antimony (Sb), Beryllium (Be), Borates, Chromium (Cr), Cobalt (Co), Coking coal, Fluorspar, Gallium (Ga), Germanium (Ge), Gold (Au), Indium (In), Magnesite, Magnesium (Mg), Natural Graphite, Niobium (Nb), PGMs Phosphate Rock REEs (Heavy), REEs (Light), Silicon Metal, Tin (Sn), Tungsten (W)
Challenges to Circular Economy	<p>Barriers to transform towards a Circular Economy:</p> <ul style="list-style-type: none"> - Economic challenges – competitive disadvantage - Planned obsolescence - Current economic models and investments - Access and availability of technology - Consumption behaviours - Political barriers 	<p>Students are able to:</p> <ul style="list-style-type: none"> • discuss the perceptions of the impact on the economy (businesses, jobs, government revenue) due to a decrease in demand for products associated in the short and long term. • identify the challenges hindering the paradigm shift to a circular economy - current investments, access to technology, political/policy barriers, production costs/competition, reduction in demand and consumption, fear of slowing down the economy etc. • identify the challenges associated with the recycling of raw materials – collection,

		<p>dismantling, handling the release of toxic materials, the variety/complexity of resources in the materials.</p> <ul style="list-style-type: none"> • identify the need for drivers that can facilitate the transition to Circular Economy. • discuss why environmental improvement is often seen as a cost for manufacturing industries, as opposed to a means for financial gain. • realise that the need for product replacements is pushed by corporations through advertising and design. • identify products that have been manufactured for obsolescence. • research why and how people accept and accommodate ever-shorter product lifespans into their everyday lives.
<p>Guiding Principles and Strategies for Circular Economy – An Integrative Approach</p>	<p>Waste Minimization: zero waste, carbon neutral, reduction of toxic substances, energy efficiency. Design: natural capitalism, biomimicry, efficient material management, cradle to cradle, design criteria based on material health, material re-utilization, renewable energy, natural resources etc. Reworking economic systems and policies: producer responsibility, industrial ecology, servitisation, diversion of resources, economic incentives. Social: stewardship, social fairness. Digital technology. Life Cycle Assessment: cradle to cradle, material and energy flow.</p>	<p>Students are able to:</p> <ul style="list-style-type: none"> • identify that circular economy is not a new concept, but an amalgamation of many strategies in practice as required commitment through promoting reuse, repair, refurbishment, recycling, product design and manufacture, and fostering system eco-effectiveness. • explain that the circular economy concept spurs valuable thinking around eliminating waste, decreasing primary resource dependency and increasing resilience over time. • illustrate through examples that circular economy involves identifying and implementing pathways through manufacture, use, reuse and recycling processes that drastically reduce or even eliminate the generation of waste. • conclude that in a circular economy, products are made to be made again and digital technologies allow us to track materials and take advantage of access to products over ownership, nutrients are returned to the soil, structural waste is put to effective use, and the whole system is powered by renewable energy. • recall that circular economy is framed on the principles of the 9Rs (refuse, reduce, reuse, repair, refurbish, remanufacture, repurpose, recycle, recover).

		<ul style="list-style-type: none"> • relate to the fact that due to the rising complexity of modern consumer goods consisting of an increasingly complicated mixture of metals and non-metals, there is a need to shift recycling practices from a material-centric to a product-centric view. • list the key principles of a circular economy that includes “designing out” waste, separating the biological from technical nutrients where the first are returned to the biosphere, and the second are reused indefinitely, and using renewable energy to decrease resource dependence and increase system resilience. • challenge the current paradigm of recycling with a circular economy that places a greater emphasis on using renewable stock and composting to capture and return the biological nutrients to the biosphere. • evaluate circular economy as a broad concept comprising of economic, social and environmental aspects, in addition to focus on more sustainable use of resources, materials and energy in broader sustainability, systemic and life cycle thinking in a long-term orientation. • identify examples of products that have adopted the circular economy principles.
Designing a Circular System	Production and consumption system based on the principles of the circular economy.	<p>Students are able to:</p> <ul style="list-style-type: none"> • conclude that design plays a key role and at this stage, the environmental and social impacts of a product are defined. • appreciate that circular economy as an economic system is restorative or regenerative by intention and design. • identify the key design strategies for low waste generating material and processes. These includes: <ul style="list-style-type: none"> • increasing efficiency by closing, slowing, and narrowing the resource flows in production, distribution, and consumption processes. • extracting the economic value and usefulness of materials as a resource in the entire cycle of consumption and production. • increasing longevity and recyclability.

		<ul style="list-style-type: none"> • decreasing the need for several products through - renting and sharing to cut on idling of resources. • present a design of a product or service based on the circular economy. • support the accomplishment of the SDGs by arguing for a critical assessment of design, innovation, new business models, and responsible production and consumption. • list the behavioural, cultural, and other social changes as required to support progress towards a circular economy. • develop indicators for the adaption of circular economy concepts at the school level. • evaluate levels of circularity of products and services in their school. • apply the principles for designing a better production and consumption system in school.
Circular Economy and the Sustainable Development Goals	Circular Economy supports progress towards the Sustainable Development Goals (SDGs).	<p>Students are able to:</p> <ul style="list-style-type: none"> • elaborate how circular economy promises to generate benefits for business, society and the environment. • predict positive psychological and social benefits of having products that can be easily upgraded, repaired, and/or replaced. • establish links with the following SDGs: 1, 2, 3, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15. • investigate a different way of approaching environmental, social, and economic issues.
SMART Consumers	Active Citizenship. Consumer Actions for Advancing Circular Economy. Rebound effect. Greenwashing.	<p>Students are able to:</p> <ul style="list-style-type: none"> • appreciate that we live in a modern, sophisticated, global economy that does bring benefits to many people. • realise that although the industrial revolution raised living standards for many people around the world through mass production and consumption, it also created problems, including increased waste and pressure on finite resources, despite technological advances. • explain to peers why we are unable to sustain the linear economy of the 'take-make-dispose model. • conclude that circular economy is driven by the commitment of both producers and consumers.

		<ul style="list-style-type: none"> • read labels of products and services to evaluate the circularity of a product. • identify/classify a product or service for/as Greenwashing. • identify instances of companies acting hypocritically when they produce a 'green' range alongside their regular products. • investigate and report on case examples of circular economy. • select/recommend businesses that adopt principles of circular economy. • decide purchases driven by the circular economy. • practice sharing, maintaining and repairing, upcycling and recycling (downcycling), reselling, donation, renting, refurbishing and recycling. • defend individual actions that will make <i>recycling work better</i>. • identify societal values that would have to change for accepting and promoting that using/owning less is SMART. • anticipate and elaborate the rebound effect - why there could be increased consumption when the process of production becomes more efficient. • debate that 'green' products are often 'less bad'. • accept shared use of products (for example car-sharing). • participate in incentivised return (take-back schemes such as those for used car tires and plastic beverage bottles). • identify products that are repairable and recyclable. • segregate for recycling of waste. • support sustainable food production (material flows in biological processes). • monitor at a personal level, the product durability and replacement rates of products.
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Some Definitions of Circular Economy

Ellen MacArthur Foundation

A Circular Economy is “an industrial system that is restorative or regenerative by intention and design. It replaces the ‘end-of-life’ concept with restoration, shifts towards the use of renewable energy, eliminates the use of toxic chemicals, which impair reuse and aims for the elimination of waste through the superior design of materials, products, systems, and, within this, business models”. The overall objective is to “enable effective flows of materials, energy, labour and information so that natural and social capital can be rebuilt”.

European Environmental Agency

“Circular Economy provides opportunities to create well-being, growth and jobs while reducing environmental pressures. The concept can, in principle, be applied to all kinds of natural resources, including biotic and abiotic materials, water and land”.

Morgan and Mitchell

A Circular Economy is “an alternative to a traditional linear economy (make, use, dispose of) in which we keep resources in use for as long as possible, extracting the maximum value from them whilst in use, then recovering and reusing products and materials”.

Sauvé et al.

Circular Economy refers to the “production and consumption of goods through closed-loop material flows that internalize environmental externalities linked to virgin resource extraction and the generation of waste (including pollution)”.

Ghisellini et al.

“Circular Economy involves the radical reshaping of all processes across the life cycle of products conducted by innovative actors and has the potential to not only achieve material or energy recovery but also to improve the entire living and economic model.”

Yuan et al.

“Although there is no commonly accepted definition of Circular Economy so far, the core of Circular Economy is the circular (closed) flow of materials and the use of raw materials and energy through multiple phases.”

Chen

“To solve the contradiction of limited resources and the increased consuming desire of human being[s] and to make use of natural resources rationally to achieve sustainable development, the circular economic development mode follows the pattern of ecological circulation and is based on the recycling of material resources.”

Murray et al.

“The Circular Economy is an economic model wherein planning, resourcing, procurement, production and reprocessing are designed and managed, as both process and output, to maximize ecosystem functioning and human well-being.”

Zink and Geyer

“The core of the circular economy refers to three activities: reuse at the product level (such as ‘repair’ or ‘refurbishment’); reuse at the component level (e.g., ‘remanufacturing’); and reuse at the material level (‘recycling’).”

Korhonen et al.

“Circular Economy is a sustainable development initiative to reduce the societal production-consumption systems’ linear material and energy throughput flows by applying materials cycles, renewable and cascade-type energy flows to the linear system. Circular Economy promotes high-value material cycles alongside more traditional recycling and develops systems approaches to the cooperation of producers, consumers and other societal actors in sustainable development work.”

References

- Alcoforado, F. (2015). *The Circular Economy to Avoid Depletion of Natural Resources of Planet Earth*. Global Education Magazine. Accessed on 5th July 2020 from <https://www.globaleducationmagazine.com/circular-economy-avoid-depletion-natural-resources-planet-earth/>
- Anttonen, M., & Repo, P. (2017). Emerging consumer perspectives on circular economy. Presented at the 13th Nordic Environmental Social Science Conference HopefulNESS, 6.-8.6.2017, Tampere, Finland.
- Atstaja, D., Benders., J, Dimante, D., & Tambovceva, T. (2016). *Development of Business Education for Circular Economy in Latvia*. New Challenges of Economic and Business Development – 2016 May 12–14, 2016, Riga, University of Latvia.
- Autio, S., Cura, K., & Medkova, K. (2015) *Students Are Learning Circular Economy with Companies in the REISKA Project*. Finland: Lahti University of Applied Sciences.
- Bergema, R, de Jong, S, van der Gaast, M, Kraak, J, & Usanov, A. (2016) *The Circular Economy and Developing Countries. A data analysis of the impact of a circular economy on resource-dependent developing nations*. COE-RESOURCES ISSUE BRIEF 3. Netherlands, Centre of Expertise on Resources.
- Bocken, N. M. P., Geissdoerfer, M., Hultink, E.J., & Savaget, P. (2017). *The Circular Economy e A new sustainability paradigm?*. Journal of Cleaner Production 143 (2017). P 757-768.
- Bodkin, G., Todorova, S., & Veleva, V. (2017). *The need for better measurement and employee engagement to advance a circular economy: Lessons from Biogen's "zero waste" journey*. Journal of Cleaner Production 154 (2017). P. 517-529.
- Boiten, V. J., Li-Chou Han, S., & Tyler, D. (2017). Step by step towards the Circular Economy. Textile Issue 1 2017. P. 14-15.
- Brown, A., Millward-Hopkins, J., Busch, J., Purnell, P., Velis, C. A., Hahladakis, J. N., & Zwirner, O., (2017). A pathway to circular economy: Developing a conceptual framework for complex value assessment of resources recovered from waste. Journal of Cleaner Production 168 (2017), 1279-1288.
- Camilleri, M. (2018). Closing the Loop for Resource Efficiency, Sustainable Consumption and Production: A Critical Review of the Circular Economy. (2018) International Journal of Sustainable Development, Available at SSRN: <https://ssrn.com/abstract=3119575>
- Camocho, D., Ferreira, A. M., & Vicente, J. (2018) *TRANSition to circular and sustainable economy through design*. Proceedings of the 5th Design Doctoral Conference, DDC'18: Transgression. IADE - Universidade Europeia, 20 to 22 June 2018.
- Curiel de Haidar, X. *Biomimicry and Circular Economy. Circular what?*.
- Dahl, O., Hughes, M., Husgafvel, R., Kanerva, J., & Linkosalmi, L. (2018). *Forest sector circular economy development in Finland: A regional study on sustainability driven competitive advantage and an assessment of the potential for cascading recovered solid wood*. Journal of Cleaner Production 181 (2018). P 483-497.
- Domingues, J., Fonseca, L., Martins, F., Pereira, M., & Zimon D. (2018). *Assessment of Circular Economy within Portuguese Organizations*. Sustainability 2018, 10, 2521. *Education and the "New Economy"*.
- Elia, V., Gnoni, M. G., & Tornese, F. (2016). *Measuring circular economy strategies through index methods: A critical analysis*. Journal of Cleaner Production (2016). P. 1-11.
- Elks, J. (2019). *Why I Believe We'll Achieve A Circular Economy*. Available at https://www.huffpost.com/entry/circular-economy-cpg-waste_b_5ce470ade4b0547bd12e89dd?guccounter=1&guce_referrer=aHR0cHM6Ly9kay5zZWYyY2gueWFob28uY29tLw&guce_referrer_sig=AQAAAMjOQRQxPpX8SKdXmNk96FBOIe6A-

sOkvUngGgbxJNaiBljFmnyvCGsLu12tu6DVT8wBqWxn-qbiXdJq15X1kCiLZXNb-w09Vk-
_VWKAIYiMDohyUVihvIDPvrS0CXiU7BKBpHzX5lrDQsOI1EnB06JK_IG1BEL8kzuJt4BWf8oF

Ellen MacArther Foundation. (2020). *The Future of Cities*. Ellen MacArther Foundation. Available at <https://www.ellenmacarthurfoundation.org/>.

Ellen MacArther Foundation. (2020). Schools & colleges resources. Available at <https://www.ellenmacarthurfoundation.org/>

Flynn, A., & Hacking, N. *Setting standards for a circular economy: A challenge too far for neoliberal environmental governance?*. *Journal of Cleaner Production* 212 (2019). P 1256-1267.
Guardian. Circular economy. Available at guardian sustainable business

Haberl, H. (2012). Addicted to resources. Available at <http://www.igbp.net/news/features/features/addictedtoresources.5.705e080613685f74edb800059.html>

Harald, W. *Beyond Planned Obsolescence. Product Lifespans and the Challenges to a Circular Economy*. *GAIA* 25/3 (2016): 156 –160.

<https://www.theguardian.com/sustainable-business/series/circular-economy>

Ikerd, J., (2006). *Is Capitalism Sustainable?*. Small Farm Today Magazine, Missouri Farm Publications, Clark, MO.

Jeffries, N. (2017) *Circular Economy: From Theory to Action*. Available at <http://www.chinawaterrisk.org/opinions/circular-economy-from-theory-to-action/>

Kluczkowski, A., & Wprostkiewicz, M. (2018). *Circular Economy as an Important Subject of Environmental Education in the Era of Energy Demand* *Journal of Vasyl Stefanyk Precarpathian National University* Vol. 5, No 1 (2018). P 88-94.

Kopnina H. (2018) *Teaching Circular Economy: Overcoming the Challenge of Green-washing*. In: Dhiman S., Marques J. (eds) *Handbook of Engaged Sustainability*. Springer, Cham. https://doi.org/10.1007/978-3-319-53121-2_48-1

Kopnina H. (2018) *Teaching Circular Economy: Overcoming the Challenge of Green-washing*. In: Dhiman S., Marques J. (eds) *Handbook of Engaged Sustainability*. Springer, Cham. https://doi.org/10.1007/978-3-319-53121-2_48-1

Kopnina, H. (2019). *Green-washing or best case practices? Using circular economy and Cradle to Cradle case studies in business education*. *Journal of Cleaner Production* 219 (2019). P 613-621.

Kopnina, H., (2017). *Discussing Practical and Educational Challenges in Teaching Circular Economy*. *Global Opportunities for Entrepreneurial Growth: Coopetition and Knowledge Dynamics within and across Firms*, 513–528. *Advanced Strategies in Entrepreneurship, Education and Ecology*.

Kopnina, H., (2018) *Circular economy and Cradle to Cradle in educational practice*, *Journal of Integrative Environmental Sciences*, 15:1, 123-138, DOI:10.1080/1943815X.2018.1471724

Leech, G. (2019). *The Elephant in the Room: Capitalism and Sustainable Development*. Available at <https://www.counterpunch.org/2015/10/16/the-elephant-in-the-room-capitalism-and-sustainable-development/>

Martinez, V. G. (2016) *The science behind a Circular Economy*. The Great Recovery.
Medkova, K. 2016. *TRILOGY ON CIRCULAR ECONOMY*. Lahti University of Applied Sciences, Degree Programme in Urban Sustainability.

Mitrovic, D., & Veselinov, M. (2018). *Measuring Countries Competitiveness in Circular Economy - Composite Index Approach*. Quantitative Models in Economics, Page 417-436. Beograd: University of Belgrade, Faculty of Economics Publishing Centre.

Mostafa, M. M. M., & Saleh, B. S. (2019). *The Cognitive Economy: An approach to Developing the Faculties of Education Competitive Abilities*. European Scientific Journal December 2016 edition vol. 12.

OECD. (2019). *OECD Future of Education and Skills 2030, Conceptual learning framework. Concept notes: Knowledge for 2030*. OECD Future of Education and Skills 2030.

OECD. (2019). *OECD Future of Education and Skills 2030, Conceptual learning framework. Concept notes: Attitudes and Values for 2030*. OECD Future of Education and Skills 2030 Concept Note.

OECD. (2019). *OECD Future of Education and Skills 2030, Conceptual learning framework. Concept notes: OECD Learning Compass for 2030*.

OECD. (2019). *OECD Future of Education and Skills 2030, Conceptual learning framework. Concept notes: Student Agency for 2030*.

OECD. (2019). *OECD Future of Education and Skills 2030, Conceptual learning framework. Concept notes: Transformative Competencies for 2030*.

Pokorná, E., Samáková, J., & Špirková, M. (2018). *Environmental issues elimination through circular economy*. American Institute of Physics. In: Dhiman S., Marques J. (eds) Handbook of Engaged Sustainability. Springer, Cham. https://doi.org/10.1007/978-3-319-53121-2_48-1

Redress Limited. (2020). *Circular Design Strategies*. Available at <https://www.redressdesignaward.com/learn/strategies>

Scott, J. T. (2013). *The Sustainable business. A Practitioner's Guide to Achieving Long-Term Profitability and Competitiveness*. UK: Greenleaf Publishing Limited. ISBN: 9781907643897

Sharma, P., & Andreou, N., (2018). *Positive Actions for Sustainable Development Goals*. Foundation for Environmental Education. Available at www.fee.global.

Shukla, S., (2017). *A Current View of The Circular Economy*. Bangor Business School: ASB-4413 International Strategic Management.

Sorin, F. (2019). *Circular Economy case study: Integrated farming systems*. Available at https://www.academia.edu/36550543/Circular_Economy_Integrated_farming_system_case_study_pdf

Spangenberg, J. H. (2015). *Beyond Circular Economy and Environmental Modernisation: Towards Social and Ecological Transitions – Elements for a Path for Social and Ecological Transformation in Europe*. Presentation at the conference: Seizing an Alternative: Toward an Ecological Civilization. Session “Ecological Civilization”, Track 6: Birth-pangs of ecological civilization. June 4th–7th, 2015, Pomona College, Claremont, California, USA.

Srisruthi, K. M. (2020). *Circular Economy*. International Research Journal of Trend in Scientific and Development (IJTSRD) Volume 1. P. 566-569.

Tari, A. (2020). *Integrating Circular Economy Concepts into Universities Around the World*. GEEP: Global Environmental Education Partnership. Available at <https://thegeep.org/learn/case-studies/integrating-circular-economy-concepts-universities-around-world>

Wang, L. *La communication du concept d'Economie Circulaire et sa nouvelle définition : approche comparative France-Chine*. 5th International Research Meeting in Business and Management - Nice 2014

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