

THE PIVOTAL ROLE OF CIRCULAR ECONOMY IN THE AMERICAS

ADDRESSING CLIMATE,
SUPPLY CHAIN, AND OTHER RISKS



Circularity Edge™

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Why this Paper?

The Circular Economy is a relatively new framework to the United States. This paper demystifies this framework by looking at the pitfalls that can be associated with implementing it. If not rolled out with skill and awareness of context, the circular economy can do more harm than good and can easily go the way of so many earlier sustainability initiatives: A green veneer on old-school paradigms that don't work anymore.

Yet, given the current state of the United States and the world, especially in regard to climate associated mayhem and the ongoing pandemic, we need new ways of perceiving, strategizing and acting on our interrelated challenges to continue to create opportunities for all, and the Circular Economy does have the potential to do just that.

This paper does not offer an introduction to Circular Economy, or a handwringing account of the disasters and challenges that are facing us. Instead, it brings several novel perspectives, e.g. why a sustainable circular economy and climate strategy should be fully integrated for effective change, and what some of the pitfalls are when the concept is simplified and the lessons learned.

Intended Readership

This paper is for you; an informed and driven professional from industry, government (local and Federal), academia, or consulting who feels an urgency to step up to today's challenges, and who is already somewhat familiar with or curious about a sustainable circular economy, and who wants to have a no-nonsense account on what's important to work with it.

Circularity Edge, LLC.
www.circularityedge.com
Rhode Island, United States

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The views, thoughts, and opinions expressed in this paper are solely of the author.

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Introduction

The United States has always been a leader in technological innovation and creating opportunities for economic growth and value. However, nowadays, the world is changing exponentially faster than we can often anticipate and this is challenging for U.S. businesses and government, both federal and regional. These challenges compound each other in significant ways. The COVID-19 pandemic erased the equivalent of 255 million jobs globally in 2020, and has been creating supply chain disruptions. At the same time, the world faces a profound environmental crisis, with our climate changing faster than we can adapt, let alone repair. According to the IPCC's Working Group I report released in August 2021, human-induced climate change is already affecting weather and climate extremes in every region across the globe; in the future, these extremes will become larger as global warming intensifies. The wildfires and floods right here in our country are proof.

In regard to climate change, the United States is laying out a comprehensive strategy to combat its main causes and effects as stated in the White House Executive Order of January 27, 2021: *"Climate considerations shall be an essential element of United States foreign policy and national security. The United States will work with other countries and partners, both bilaterally and multilaterally, to put the world on a sustainable climate pathway. The United States will also move quickly to build resilience, both at home and abroad, against the impacts of climate change that are already manifest and will continue to intensify according to current trajectories. Furthermore, the United States will also immediately begin to develop a climate finance plan, to assist developing countries in implementing ambitious emissions reduction measures, protecting critical ecosystems, building resilience against the impacts of climate change, and promoting the flow of capital toward climate-aligned investments and away from high-carbon investments."*

This is an unmistakable message that climate change is now clearly recognized as a global crisis by the Federal Government and so it is by many business organizations.

According to the World Economic Forum (WEF), "business, governments and citizens around the world increasingly recognize the challenges caused by our 'take-make-dispose' approach to production and consumption." In 2019, over 92 billion tons of materials were extracted and processed, contributing to about half of global CO₂ emissions, and many other interrelated global challenges.

In fact, many of today's nature- and environment-related problems can be traced back to the inefficient and wasteful use of natural resources triggered and exacerbated by the linear global economic system we have created since the early 1800s starting with the Industrial Revolution. This leads to pollutants being emitted to air, water and soil, which in turn have undesirable effects such as plastic soup in the oceans, including plastics in our direct environment and even inside our bodies, ecosystem degradation from mining, generation of large mountains of waste

and loss of biodiversity, which equates to reduced resilience in the ecological systems that support our life on this planet.

"We always have to accentuate the core problem that generates these unwanted symptoms/effects, which is in essence the global linear economic system that we as humans have created.

However, as Albert Einstein said: "The world as we have created it is a process of our thinking. It cannot be changed without changing our thinking."

Thus, we need to rethink our global linear economic system, as this is the origin of many of the social and environmental problems we have at the planetary level."

These problems will become more pressing in the coming decades, due to the increase in global demand and utilization of material resources (e.g. minerals, metals, fossil fuels, biomass) mainly due to population growth and billions of people attempting to reach an increased standard life for themselves and their families. The growing use of such resources and the interdependencies in the long international production and/or value chains will also increase supply chain risks and are likely to cause price volatility affecting U.S. businesses, consumers and (local) government alike.



How well are we in the United States equipped for the future; tomorrow, mid-term, let alone long-term? What country or world will our children inherit? What is needed to thrive as a business, community and family in the "new normal?" How can we ride the wave of the changes that are happening and avoid sudden potentially destructive effects? What technical, economical, and cultural frameworks and methods can help us do just that?

About this paper

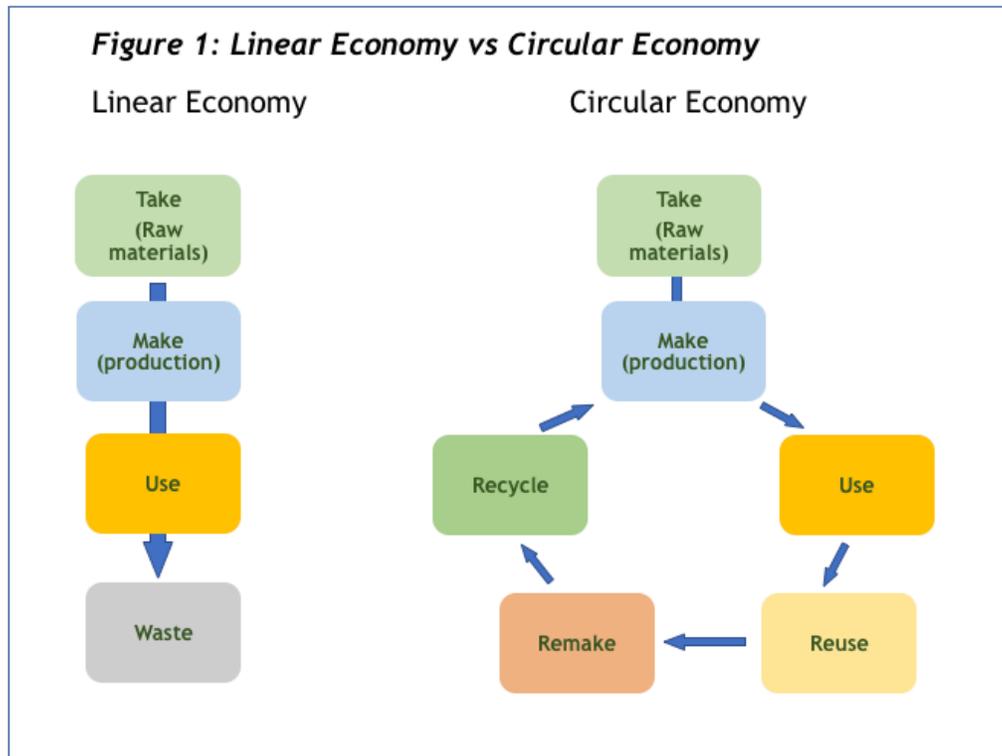
This paper focuses on the "sustainable circular economy" as an alternative economic framework; currently the most practical and advanced framework and pathway forward that offers actionable solutions to achieve a better balance and more harmonious relationship of humans with nature within the planetary boundaries while thriving as a species. Yet there are many pitfalls along the path. Experience from Europe and also Latin America shows us that the circular economy has been slow and difficult to implement in a significant, sustainable and sustained way. It has to be done right from the beginning. For example, it needs to integrate climate, biodiversity, natural resource, ocean protection, economic development, and general sustainable development policies and actions, as well as support social cohesion and the creation of meaningful jobs.

This paper describes these pitfalls and offers steps to avoid them, building upon the experience from other places and from front-runners in the United States. It includes key lessons learned and identifies the new patterns emerging from the complexity of today which can guide the way to a successful implementation of a sustainable circular economy. It also offers a solid introduction to the wisdom and new skillset needed to become a master at navigating today's unpredictable storms.

What this paper does not do is rehash climate problems, and mitigation strategies. It does present a brief introduction to the Circular Economy because without that knowledge it becomes hard to place the needed interdependent solutions in the context of interdependent challenges. Neither does this paper present success stories or case studies about circular solutions. There are many other sources that do that already and while inspiring, success stories, are notoriously hard to transpose into another context. Instead, the paper highlights two overarching solutions that are currently 'hot;' shared assets platform and new forms of education.

Circular Economy 101

According to the WEF, "business, governments and citizens around the world increasingly recognize the challenges caused by our 'take-make-dispose' approach to production and consumption." In 2019, over 92 billion tons of materials were extracted and processed, contributing to about half of global CO₂ emissions. The resulting waste—including plastics, textiles, food, electronics and more—is taking its toll on the environment and human health.



The Circular Economy, in contrast, aims to radically limit the extraction of raw materials and the production of waste. It does this by recovering and reusing as many of the products and materials as possible, in a systemic way, over and over again, inspired by living systems; the natural cyclical processes that occur in nature. The Circular Economy is a "make/remake – use/reuse" economy. See Figure 1.

The Circular Economy is inspired by Living Systems

What are the characteristics of living systems, and how do they relate to our manmade systems?

1. There is no such thing as waste in living systems. One species waste becomes another species food. If we redesigned products so they could be reused or disassembled at the end of life or use, we could keep those products and their materials at their highest value at all times. A Circular Economy starts with design so all 'waste' or nutrients/resources can be reused. (compare to Cradle to Cradle™)
2. Living systems are diverse. Many species contribute to the overall health of a system. Greater biodiversity supports a system at a time of shock. An economy, a nation or a company can derive greater value from diversity by sharing strengths and having a greater pool of resources to draw on. Such a system would also be better able to bounce back from disruptive events, building in resilience through diversity.

3. Living systems are powered by renewable sources. If we are to build a circular economic system to work in the long term, then we need to work towards energy from renewable sources using suitable technologies and solutions.

A circular economy isn't about one company changing one product. It's about many actors working together to create effective flows of materials and information, with everything increasingly powered by renewable energy. When we think in systems, we begin to see the connections between people, places and ideas. And we begin to see how we can create opportunities to generate economic, environmental and societal gains. This is why we need to think in systems, and that is the fourth principle of the circular economy.

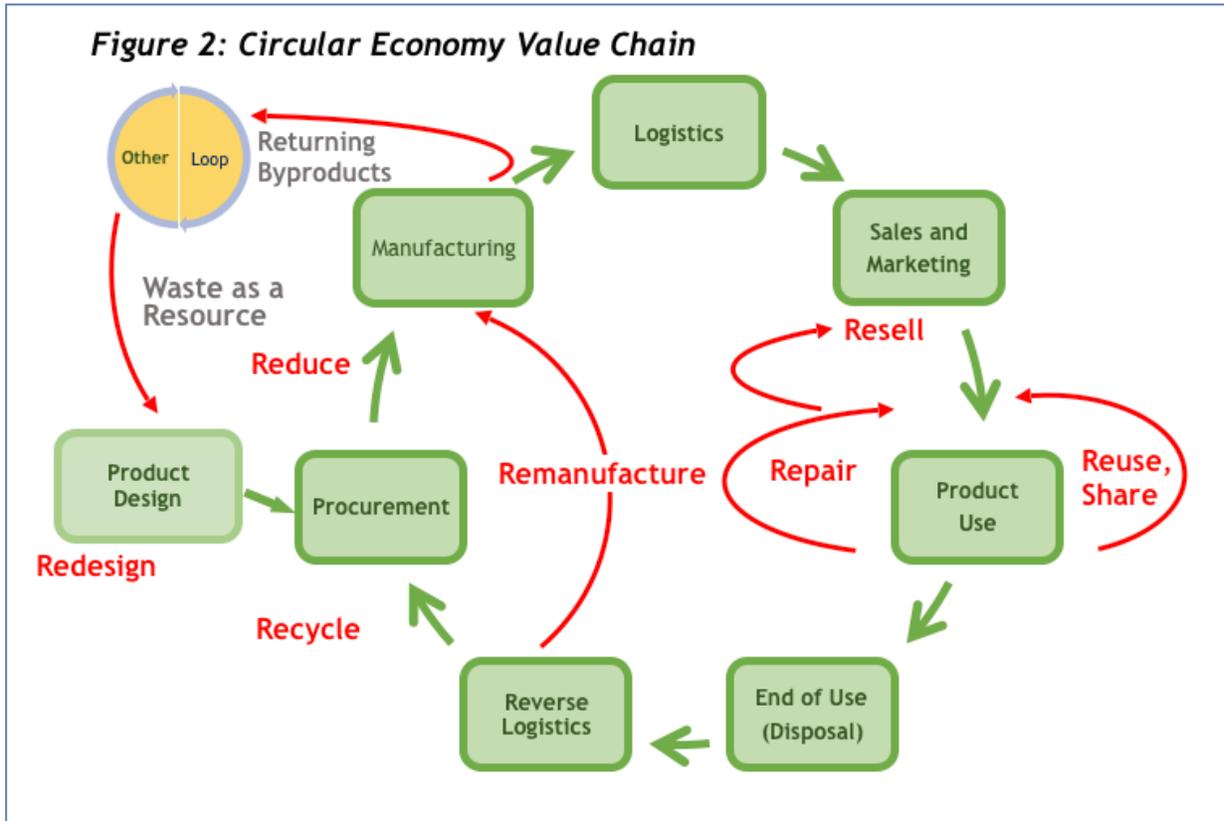
In our definition of a sustainable circular economy we build on what is often referred to as the R-ladder. Each step is a strategy in and of itself. These strategies include:

1. **Rethink** the economic or business model to be sustainable from the onset;
2. **Re-assess** the need to use products/materials or anything "physical" (digitalization, virtualization, dematerialization or de-consume) to satisfy a human need;
3. **Refuse** or reject certain materials or components (e.g., because of their toxic-content and/or suboptimal design), as they represent liabilities and costs down the line;
4. **Redesign** – refuse intentionally built-in obsolescence as a design principle. Instead design products that can be taken apart and repaired;
5. **Reduce** – once the design is improved, manufacture products more efficiently using fewer resources;
6. **Reuse** – redistribute and share adequately designed products, for example on sharing market places that are now booming;
7. **Repair & Remanufacture** products to extend products and their components' life and use;
8. **Recycle** - reduce waste generation and fewer new material resources are needed,
9. **Recover** - the least favorable where the energy content is recovered by burning materials.

Within a circular economy, there are multiple loops or cycles that correspond to varying degrees of efficiency and represent elements of the R-ladder. The inner loop(s) is where rethink and redesign will have a significant role. Other loops include remanufacturing and reuse, while the outer loops would represent recycling and recovery of energy. Figure 2 shows a typical value chain from a circular economy perspective, indicating how loops may look using several elements of the R-ladder. In order to close the loops a proper business model is needed that guarantees profitability in the long run. In a closed loop we can identify three main business processes that connect with one-another. If any of these key processes is not addressed, we do not have a closed loop. Closing the loop on the product or part/component level potentially generates much more value than on the material level. The three main business processes required to close loops are:

- Acquisition (collect the right volumes of products or materials of the right quality, for a reasonable price)

- Reprocessing (refurbish, remanufacture or recycle used products or materials, for a reasonable price)
- Remarketing (identify markets that want to buy the reprocessed products or materials)



Pitfalls to Implementing the Circular Economy

"If we recognize that we should start with re-assessing how a human need can be satisfied (sometimes without the need of physical products/materials), this opens also the opportunity to look into easy/simple practical solutions that do not require highly complex technologies/infrastructure and thus capital."

Moving away from a linear to a more circular economy is easier said than done. As mentioned, experience from Europe, Latin America and elsewhere, demonstrates that the circular economy has been slow and tricky to put into practice. A recent paper¹ offers critiques of the circular

¹ Corvellec H., Stowell, Alison F. and Johansson. N. 2021. Critiques of the circular economy. Journal of Industrial Ecology 2021;1-12. wileyonlinelibrary.com/journal/jiec

economy, which if not heeded can also be a threat to finding solutions in the United States. The author noted in the introduction that a critique does not consist of stating that things are not good as they are. Instead, it is about seeing what kinds of self-evident, acquired and non-reflective modes of thought, as well as the practices we accept are based on. And hence, what can be learned from and improved upon. Below, we take a closer look at these critiques. The quotes are from Corvellec, et al. 2021.

Lack of a Clear Definition

Just as with sustainability the term 'circular economy' means different things to different people. The pitfall here is that actors (engineers, scholars, business, policy makers etc.) will define circular economy according to their perception and cultural context. Unless skillfully facilitated at the beginning, the definition issue will lead to various interpretations. "Circular Economy is a multiplicity, an umbrella concept that creates excitement and enthusiasm as it seemingly provides a new framing able to resolve many problems, but it comes under increased scrutiny when attempts at operationalization bring to the surface unresolved issues regarding its definition.

Perception of Waste

Another potential pitfall, not dissimilar to the one above, is the definition and classification of waste. The forerunner of Circular Economy, Cradle-to-Cradle provided us with the catchy concept of waste=food. But when that is true, more waste would mean more food, or input for various processes. It would be better to avoid the word 'waste' altogether, and eliminate it from the vocabulary as well as from the value chain, and design materials in such a way that they can be used over and over again.

Stocks and Assets

"Circular strategies also ignore the substantial amounts of consumed material and artifacts that are stocked in homes, companies, and infrastructures. The research and practices of circular economy focus on manufactured flows rather than stocks." We simply do not know how much stuff is stored away with businesses and consumers. All these stocks represent a major (temporary) carbon and materials sink, and therefore, a potential resource.

Unclear Implementability

Implementation needs to happen at four interdependent levels: policies, finance, various organizations and individual consumers. For example, policy instruments may only cover material circulation (ie. recycling mandates) intended to bend the existing linear economy to more of a loop, but don't take the other levels into account. The importance of early stakeholder engagement and a clear broadly accepted contextual definition and associated vision may be

underemphasized or worse, forgotten about, making implementation, validation and scaling very challenging.

"Whereas linear business models are validated as soon as a certain number of products or services have been sold, a circular business model cannot be validated until recirculated products have been sold. Second, there are numerous barriers to circular business model developments, including "technical barriers such as an inappropriate technology, or lack of technical support and training; economic barriers such as capital requirements, high initial costs, or uncertain return and profit; institutional and regulatory barriers such as a lack of a conducive legal system, or a deficient institutional framework; and social and cultural barriers such as a rigidity of consumer behavior and businesses routines."

Consumer Interest

The lack of consumer interest is a common problem for green offerings. However, contrary to making linear replacements that don't require behavior change, the circular economy requires a radical reformulation of the consumer role — from consumer to user. Hence, replacing traditional ownership with dematerialized services may neither appeal to consumers nor always be feasible.

The effects of the current massive climate induced disasters might be having an effect on the willingness to change. On the other hand, people may also have an instinctual reaction to rebuild, go back to normal. Input from sociologist, behavioral scientists and transformational specialists is needed to provide input on strategies and action steps that will stick. An associated barrier is that within the old linear models, it is a lot easier to obtain funding for development of an improved or new technology design or manufacturing process, than it is for social science research.

The Circular Economy May Not be Sustainable

Just to be clear as far as definitions - we are defining the word sustainable here, as per Brundtland: "meeting the needs of the present without compromising the ability of future generation to meet their own needs," and let us add while restoring ecological systems in the meantime." Another widespread way of expressing sustainability is with the UN Sustainable Development Goals (UNSDGs) shown below.

While in theory the circular economy is inspired by living systems, it can easily be simplified into a method that only looks at material flows, resources and waste sinks. If not viewed systemically, it omits the amenity base and life-support features of the surrounding environment. It addresses neither the critical importance of land as the basic source of biomass, energy, and mineral reserves nor the issue of the physical flows of materials and energy cross organizational, administrative and geographical boundaries whereas it should encompass the complex network of primary flows required to sustain the functionality of the biosphere within



which the economy is operating. In a way one may say that the driving factor, which is enriching and sustaining LIFE can easily be left out of the equation. The question is, how can LIFE as overarching theme and expressed in key indicators be fully integrated into a circular economy vision, strategy, tactics and goals?

Is the Circular Economy Avoiding Hard Questions?

The paradox here is that the Circular Economy is often framed as a managerial and technocratic, “matter-of-fact issue”. This technocratic or techno-scientific representation reinforces the circular economy as an eco-modernist agenda, thereby bringing a certain enthusiasm and premise that we don't need major change and can get by, by moderating material flows, introducing more renewable energy and happily sharing some, but not too many assets, if we want. At the same time, we may be avoiding confronting the hard questions in how far the current way of doing things, doing business and doing politics is still suitable to address today's global critical issues, be they climate change, pandemic, labor/job or critical metal related.

The circle metaphor is certainly popular and powerful and may trigger creative thinking. However, visions of the circular economy may also give promises that cannot be reached. In fact, this is another way of saying that the circular economy can't just be a catch add-on to a project that will magically reduce waste and create economic growth. A circular economy initiative requires, critical reflection and a solid and careful assessment of the cultural, social, political and industrial/technological context it is supposed to be enacted in. This will shed

light on the existing circumstances in which it can succeed and what stakeholder processes are needed to create a vision, enthusiasm and action steps, and measurable objectives.

"What is clear from the critiques is the need for further dialogue and how the circular economy agenda needs to include civic society and must reclaim ownership from business and policy if it is to drive the new transition."

In these days of compounding global risks, we can't afford to have the circular economy go the way of many earlier 'green' initiatives by promising things it can't deliver if not handled properly, or else, it will just become another way to greenwash the linear status-quo.

Less bad is not the same as good

William McDonough

Another pitfall is related to efficiency. Incremental efficiency improvements that result in the reduction of either the use of materials or energy are not going to help if economic growth is greater than the improvement. For example, if we make airplanes 5% more fuel efficient, and airline travel increases by 7%, we have gained nothing. In these critical times, efficiency improvements and carbon intensity metrics are directly embedded in old-style linear thinking. This is why we have to change our thought processes to a more systemic mode that includes innovative redesign, not just of technologies, but also of business models, policies and consumer preferences. In other words, we have to learn, and we have to learn fast. Circularity Edge has developed novel experiential learning techniques that can offer guidance.

Avoiding Failure - Latest Observations from the Field

Circularity Edge LLC is the frontrunner firm in the United States working on strategic circular economy issues. We always have our eyes open to find the patterns that work taking circular economy processes to success. Just as we also discern the failure patterns which are just as valuable to increase the skills and wisdom needed to guide our clients toward the best outcomes. The latest findings: ²

Reducing Supply Chain Risks

Although it is true that resource efficiency has increased, this has not led to a sharp reduction in the use of raw materials. Manufacturers will be dealing with increasing supply risks, especially

² Certain sections are taken from a report published by PBL, the Netherlands Environmental Assessment Agency titled: Netherlands Integral Circular Economy Report. Hanemaaijer, A. et al., January 2021. <https://www.pbl.nl/en>. (PBL, 2021)

in regard to their dependence on critical metals, cobalt, tungsten, tantalum, tin, silver and indium. These critical metals are used seemingly everywhere: in machines, electronics, electric vehicles and are essential renewable energy equipment.

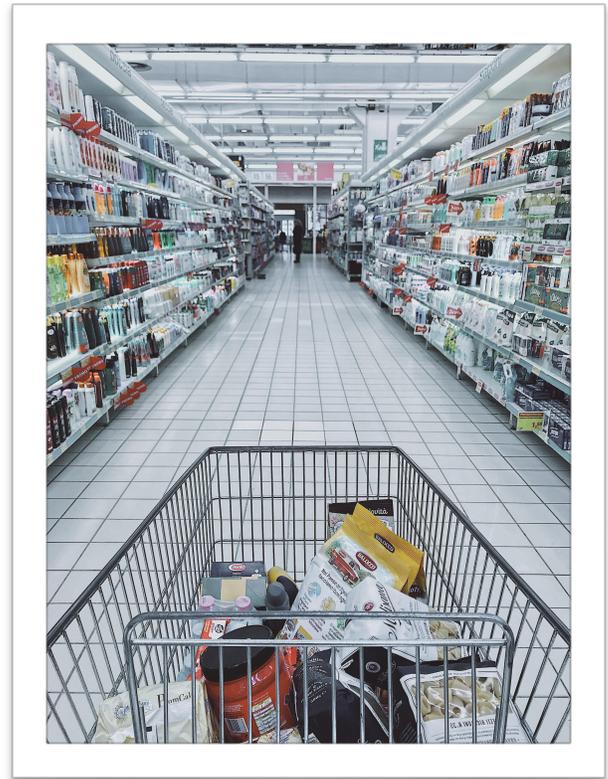
Moreover, more consumption also requires more and more land in the production chain. And more consumption continues to increase global waste dumps and associated pollution specially to water ways.

Educate!

There is increasing awareness with governments, large international organizations and business especially in Europe, United Kingdom, Latin America and the Caribbean, and spotty in the rest of the world. The number of companies focusing on circular activities is increasing.

Looking at the most recent events concerning both climate disasters and shortages in critical metals, the awareness of the circular economy is likely to exponentially increase. This is why it is so important now to 'get it right'.

Consumer behavior and psychology needs more research. For example, studies indicate that only minorities of consumers are open to using most refurbished or recycled products. On the other hand, consignment shops are booming and people seem to have no problem sleeping in used beds in hotels. In spite of climate misery, from floods, fires and droughts, we can see how the human need for security and familiarity has people rebuild in the areas that are risky, even while knowing that climate calamities are going to increase. Consumer behavior will have to be included in the puzzle and it will have to change fast. This is not so much an opinion as an observation, because running up against the planet's natural boundaries will force change anyway. Already there are many millions of migrating 'climate' refugees.



Contrary to making linear replacements that don't require behavior change, the circular economy requires a radical reformulation of the consumer role — from consumer to user.

Clear Government Policies and Financial Resources are Needed

"Without additional policy, this pressure on nature and the environment will continue to increase over the coming decades. The OECD (2019) and the International Resource Panel (2019) expect the use of raw materials to double by 2060, compared to 2017 levels, particularly due to the growing global population and the amount of consumption per world citizen. Under a scenario in which historical trends continue and taking into account climate policies such as those applied up to 2015, greenhouse gas emissions are expected to increase by 49%, by 2060, compared to 2010. The increasing demand for food and biomass is also projected to lead to an expansion of the agricultural area. This will be at the expense of natural ecosystems, such as forests and other habitats, in turn leading to biodiversity loss and a further acceleration of climate change." (PBL, 2021)

A clear, national circular economy policy is of great importance. Introduction of policies and regulatory instruments usually takes time, so it is important to start early. The PBL report (PBL, 2021) lists ten intersecting clusters of policy instruments to accelerate the transition towards a circular economy:

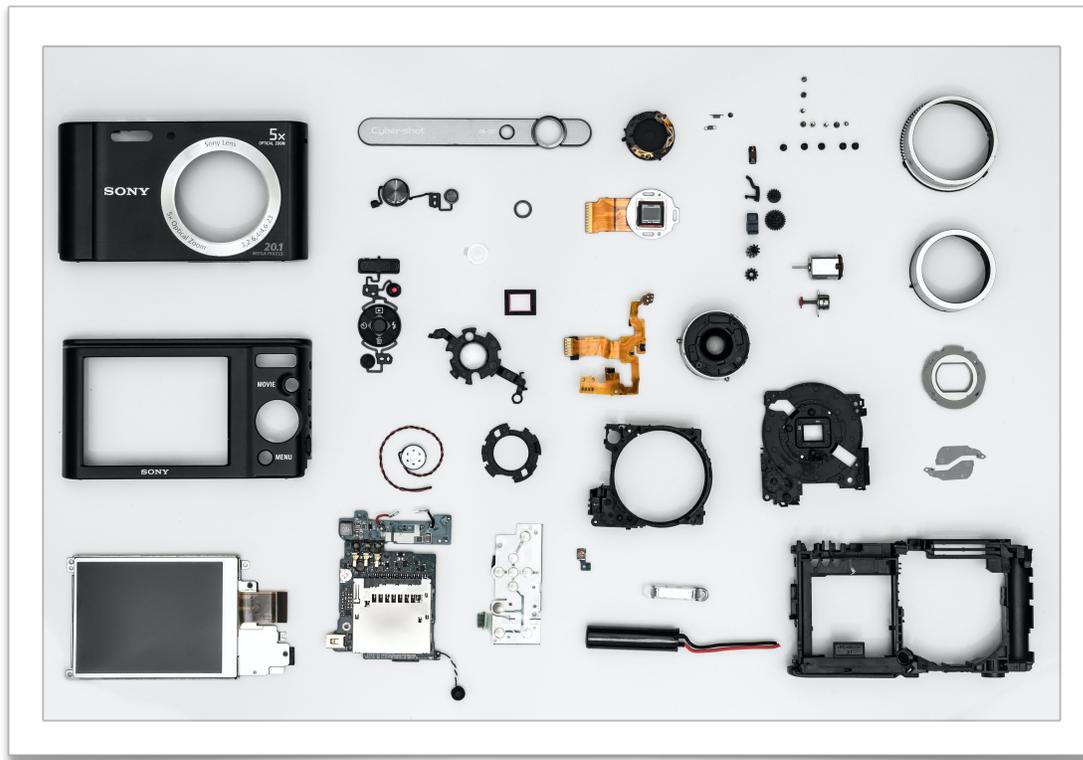
1. producer responsibility,
2. legislation and regulations,
3. circular design,
4. circular purchasing,
5. market incentives,
6. financing instruments,
7. monitoring, knowledge and innovation,
8. behavior and communication, education and the labour market,
9. international commitment and
10. regional dialogues and initiatives aimed at improved collaboration

Elements can include setting requirements for the use of material resources in product design or the prevention of harmful substances in products. Another one is enforcing producer responsibility and requirements for product design and repair. "Right-to-repair" regulations are now being introduced in France and the EU is looking at implementing these on a wider scale.

Quality Standards - Ensure that environmental damage is factored into the prices of products and services and that legislation and regulations no longer cause disadvantages for circular initiatives compared to the already established linear practices. For example, new raw materials, currently, are cheaper than recycled materials, and buyers are wary of circular products for which no quality standards have been set.

Another development we see is the use of the government's own purchasing power. Stepwise implementation increases in the circularity requirements used in government purchasing and procurement, including those in the context of producer responsibility. Examples include a

minimum recycling rate that is subsequently adjusted upwards, over time, and setting preconditions on purchasing and procurement that go beyond recycling.



Related here is how government should organize itself for optimal implementation of circular economy. Just as climate, circular economy is a cross-cutting issue. Therefore, it cannot be just a task within one department. A circular economy requires different policies and regulations that would balance consumer safety, health, environment, economy and innovation. This requires a coherent approach across different departments that each have their own role to play, yet need to be on the same page.

Integrate Circular Economy, Climate Change Strategies and Policies

In the United States there is now much focus on climate. The effects of increasing climate instability are now visible for everyone. The Biden Administration has been publishing various communications that are leading the Federal Government toward action. However, the circular economy framework remains largely unexplored in the United States. This represents both a large chance and challenge for business to get involved forthwith. It also represents imminent dangers where wins viewed through a climate lens can obscure losses in circular economy related areas, especially concerning material resources.

Climate-friendly policies and/or economic imperatives to rapidly replace less-efficient equipment can drive up the need for virgin materials and push us further away from

circularity. It is, therefore, imperative to understand the interrelatedness, opportunities and risks of both these drivers and work toward integration of climate and circular economy strategies and policies.

A good start toward integration is a hard look at 'footprint' boundaries. Climate emissions are practically always measured on a national scale. As indicated by the example above, resources and materials have effects way beyond national boundaries. The best reason to integrate circular economy and climate policy is that businesses need clarity and consistency.

On a similar note... it is also prudent to begin integrating the overall health of the environment and ecosystems. The loss of biodiversity is now becoming a critical issue due to the effects of climate change, habitat loss and pollution and therefore, constitutes a major risk.

Leading-Edge Trends for Early Success

The number of companies and cities focusing on circular activities is increasing exponentially. Often, the first effort is on recycling. There are numerous case studies on recycling of waste or obsolete products. While many stories might be inspiring, the author of this paper has deliberately chosen to forego this type of information. Case studies for your field can easily be found on the web. And in addition, recycling is still at the bottom of the "R-list" Often materials are not recycled but "down-cycled," where they can't be used for their original purpose. Recycling may also need a lot of energy. Another, more circular R is Repair. Often repair industries were already part of the linear economy. Examples include garages, bicycle repair shops, and thrift shops. Expanding repair and repair-ability can be an important step in keeping products in use longer. Furthermore, from a health perspective much can be gained, especially when recycling and repair is occurring in the "informal economy" and can be more standardized and regulated. Think of the recycling of e-waste in developing countries.

As such, recycling and repair are important but from a circular economy perspective they don't indicate significant change, unless they are placed in a comprehensive and systems-oriented, circular economy context (taking the other R-steps into account as well).

Until recently, there has been far less attention for innovations that could radically change the use of material resources. As a result, the economy still functions largely according to linear principles. This does not alter the fact that, there are experiments and entrepreneurs focused on circular product designs, alternative revenue models and online sharing platforms. Especially online sharing platforms (resource management and exchange) are growing with leaps and bounds as shared below.

Other compelling new developments are on novel learning, training and mentoring methods. Simply put, because the circular economy framework requires a new way of thinking, it also requires new ways of communication, dissemination and associated education and training. The sharing economy and experiential learning are exciting new developments that are rapidly being deployed. The trends described below offer essential information for those that are passionate for the transition to a circular economy.

Sharing Economy: Resource Management and Exchange Platforms

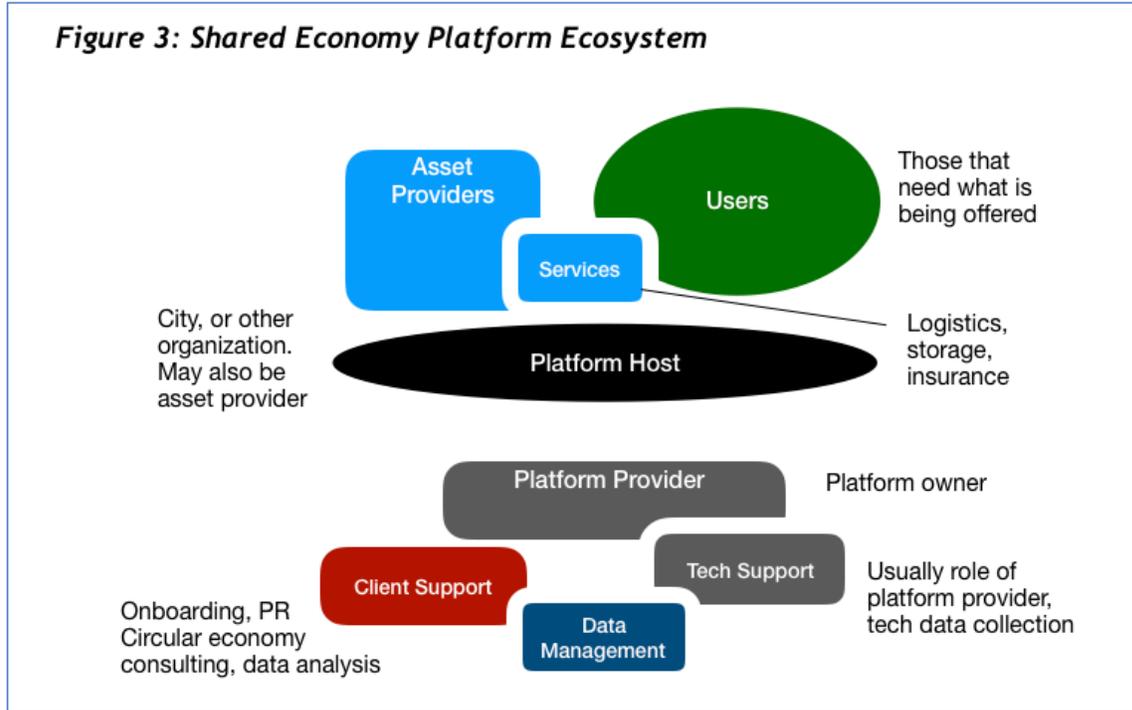
A Sharing Economy refers to an active network of participants that share a common need for providing access to their, often under-utilized assets, to monetize these in the form of purchasing, leasing or bartering instead of acquiring new assets. We are already familiar with this sharing concept through Uber with cars and AirBnB with rooms and homes. The next wave of the sharing economy is corporate assets including specialized spaces (e.g., storage, specialized labs or paint booths) to provide additional revenue, lower cost of ownership or outright sales.

What is now catapulting the sharing economy boom is the recent advances of digital platforms that are user-friendly, real-time, rapidly scaleable and offer full back-office support to handle financial transactions and data management. Revenue models can consist of membership fees or licenses, as well as micro-payments for each transaction.

Resource exchange platforms, which are often white labeled, can be deployed in any local economic zone such as a region, city, state, or country. The platform can also be deployed by institutions such as, for example, chambers of commerce, universities, hospital networks, or government agencies. The sky is the limit. A sharing economy does not only offer benefits for its participants, it can also advance key principles of circularity. Figure 3, below shows the ecosystem of a shared economy platform.

Looking at the figure above..... The platform provider (lower center) makes the platform available to the platform host, for example a city. Usually the platform is white labeled so the city can add its own logo and flavors. In case of a larger city, the host can also provide assets that are underutilized (e.g., office furniture or landscaping equipment) and/or the platform can host assets from third parties that are affiliated with or in the city. Users may be other city departments, even neighboring cities, or third parties.

Typically the platform provider or owner is a technology company that will typically handle all tech support. Depending on the preferred business structure (e.g. license agreement), the technology company will retain a firm to handle sales, non-tech client support, PR, onboarding to make sure the platform is rapidly populated and that potential users are aware and enthused about the new opportunities to gain access to needed assets or materials. The window of success is short. If a platform is launched without solid buy-in and vigor, it is likely to fail.



Logistics and short-term storage of the assets in transition can be left up to the market, or it can be built into the platform. This would offer users a true one-stop-shop to trade/buy/lease assets and have them delivered immediately.

Data management is called out separately. Obviously, there is a need to track marketing data and account for transactions so micro-payments can flow back to the platform providers and their supporting organizations. However data management is also crucial for tracking sustainability and circular indicators, e.g. carbon emissions, energy savings, quantities of materials kept out of landfills, reuse efficiencies, resources staying in the local network, as well as cost savings. Such data are crucial to inform the platform host on staying financially healthy, while becoming more circular and more sustainable, be it a city, organization or business.

Advantages of Resource management and exchange market place

Benefits of a sharing market place are based on the following essential needs in regional economic zones and for institutions. Often they are applicable to providers, users and the platform hosts. As such, there was no specific ranking or categorization applied in the list below.

- **Save money.** Reduce wasteful spending on assets that may be idle or are stored in excess by leasing from others. Increase revenue by sharing your own assets, and lower the cost of storage which usually gets more expensive over time.
- **Make Money.** Facilitate earning money by leasing unused or underutilized assets.

- **Smarter purchasing decisions.** When you have visibility into your organization's unused surplus items you can make more informed decisions on what you actually need and stop buying things you already have or can easily lease using the platform as an information source.
- **Raise efficiency.** Get more things done faster by getting items close to you. When a nearby team or stockroom has something you need there is no waiting for processing and shipping - it's just there ready to go.
- **Reduce Supply Chain Risk,** because new products do not have to be shipped from afar and no new materials (critical metals) need to be mined, processed or produced.
- **Focus on local economy.** Provides an economic platform to inspire and sustain local economic development, keeping money in the local economy.
- **Contribute to a sustainable circular economy.** Becoming greener is not only good for the environment, but good for your organization. Fulfill a key part of the circular economy and turn your organization into a leader of sustainability.
- **Boost collaboration.** Connect with people and teams that you might not otherwise have had the chance before. Break down barriers within your organization or another group from your extended network.
- **Connect to a network.** When you want to expand your reach beyond your own organization, create a trusted network and gain access to resources from top companies and organizations. You're always in control of what can go in and out of your network.
- **Create Resilience.** Greater resilience of the local economy's infrastructure during crisis periods such as severe storms, economic downturns, and pandemics.
- **Gather Market Intelligence.** The platform provides insight in what tools, methods, goods are doing well or are in need and those that are less attractive.
- **Create good new jobs.** Used assets will have to be repaired, refurbished, shipped, stored, retrieved, inspected, insured. All these tasks reflect solid mid-level jobs compared to leaving these in a warehouse, or worse, having them go to waste.

New Developments in Learning and Training

COVID-19 changed the landscape of learning and planning for a circular economy: Remote work arrangements, reduced hours, and new team communication arrangements were needing to be adapted on the fly disrupting legacy leadership practices that relied on many in-person connections. Most participants in the move to on-line interaction were subjected to an avalanche of old-style eLearning methods: PowerPoints, talking heads, PDF handouts, and competency-based learning management systems. Somehow, the new content would then have to be made to fit into these old-style methods. This is not helpful because the new, circular content is more networked, contextual and multidimensional than old linear knowledge and processes and, therefore, will not "fit" into old-style methods.

To better understand and practically implement the principles of a circular economy, a comparable new paradigm for learning, performance improvement and planning is needed—one that is driven by experience, scenarios, and incentives to unleash the passions and goals of

individuals who want to take personal control of their learning, practice and fail to succeed, set goals, lead and contribute to effective teams, solve problems, and innovate. A scenario-based application of these new approaches will have a direct effect on strategic planning, managing risk, identifying trends, new ideas, and best practices in public management and innovation, and responding more effectively to mission, management and stakeholder priorities. Advances in AI, virtual reality and scenario-based, experiential learning are emerging to advance this new paradigm.

Scenario-based teaching/learning

Proven to be superior in learning outcomes to other forms of teaching, scenario-based teaching, begins with a stage of discovery to uncover both objective and subjective factors and to define specific goals and metrics for success. These are mapped to simulation mechanics, roles, scenarios, challenges, and events in a simulation that help to drive the desired changes in knowledge, skills, behaviors, attitudes, and behavioral outcomes. Similar to scenarios are serious games, simulations, and digital twins. A digital twin is a virtual representation of an object or system that spans its lifecycle, is updated from real-time data, and uses simulation, machine learning and reasoning to help decision-making. Digital Twins of cities or countries provide an exciting opportunity to learn about the principals and implications of decisions around climate measures as reflected in this digital twin of Scotland's plans for meeting Net2030 goals.



Figure 4. A digital twin of Scotland developed for climate and renewable energy purposes

Virtual Work Spaces

In the past few years, millions of students and workers were forced online for learning and remote working. Paradoxically, we need to enable learning about the circular economy and other networked systems (e.g. climate, virology, supply chain management) fast and effectively, which will also require on-line learning. So, beyond the virtual experiences and scenarios (reflecting content and context), the need for new forms of digital engagement are also increasing exponentially. Zoom, Google Meet, etc. might be seen as phase 101 of this trend. Soon we will be learning in virtual spaces.

The concept of virtual spaces to learn and work has been available for over a decade, especially in entertainment gaming and applications for children such as MineCraft and Roblox. Now the opportunity to expand upon these virtual environments for virtual meetings and conferences as well as scenario-based learning experiences has prompted announcements of an emerging “metaverse” where real-world participants Gengage with others as avatars in a virtual



world or a digital twin of a region. This form of engagement will increase both regional and global communication and cooperation significantly.

Because of the strong need for improved learning and training methods, including innovative scenario-based learning with a virtual work spaces, new learning institutions are being developed.³ Building upon a foundation of current sustainable circular economy learning assets for core content, experiential learning in the form of models, simulations, and games, can significantly accelerate learning and capacity building, and improve innovation, data collection and utilization, collaborative problem solving, decision support, and performance analysis.

Equally important, experiential learning can help drive the rapid evolution of culture and behavior needed to respond to paradigm shifts such as required to implement a sustainable circular economy culture. Other key differentiators include:

- Customization with internal and external data for greater relevancy
- Whole systems-based and data-driven strategic planning

³ <https://circularityedge.com/circular-academy>

- Integration of underlying worldviews and cultural dimensions
- An understanding of human psychology, behavior, and learning
- Ability to apply game dynamics in specific ways to achieve desired outcomes.

Experiential learning solutions must be developed through an iterative process of co-creation with the client. First, the objective and subjective factors specific goals and indicators are defined. These are mapped to simulation mechanics, roles, scenarios, challenges, and events in the subscriber identity module (sim) that help to drive the desired changes in knowledge, skills, behaviors, attitudes, and behavioral outcomes.

Overcoming the Pitfalls - The Path Forward

The significant problems we face cannot be solved at the same level of thinking we were at when we created them.

Albert Einstein

This quote by Albert Einstein can't be repeated enough. If we want to address today's intertwined, wicked problems we will have to evolve our thinking, which will require evolving our consciousness toward more holistic and systemic ways of thinking and perceiving and doing. So, what does this have to do with circular economy and addressing the urgent issues of today?

We are convinced that, if designed and implemented wisely, the circular economy is the best model that we have today to offer a pathway forward setting goals, measuring progress and formulating actionable steps. However, "Before the circular economy becomes mainstream and moves beyond sustainability and circular economy professionals, there is clearly a need for conceptual coherence about definitions, plans, implementations, and modes of evaluation, because without coherence and transdisciplinarity the expansion of new knowledge could be obstructed by deadlocked debates or can collapse entirely." (Corvellec, et. al., 2021)

In this section we focus on what we believe are the practical and essential steps in defining, strategizing and implementing a circular economy. The more philosophical topics we will leave open for now.

Where to Start

Because issues are intertwined and solutions need to be holistic / systemic, countries or regions will have to prioritize and decide where to start. It is likely that governments will have to

assume a prominent role in this process and select stakeholders from industry, non-profits, academia, the public, etc., as well as review available data. Drivers to implement a circular economy are likely to be multiple but can be broadly organized as follows:

- create lasting meaningful jobs,
- address major environmental hazards (plastic waste, hazardous waste, etc.),
- reduce resource use
- reduce supply chain risk

The good news is that, if skillfully implemented, a comprehensive circular economy program will have positive effects on all of these drivers. That is the advantage of interconnectedness. For the same token, a poorly implemented plan can have a positive effect in one area, while having negative effects in others. A good example is the electric vehicle industry. Obviously, there are big wins for local air quality and carbon emissions, but the mining and processing of (critical) metals can score minus points. Also, carbon footprints usually have a national boundary, while the greenhouse gas emissions created during that same mining and processing might be massive.

For guidance, we can look at the R-ladder. All R-strategies are needed to achieve a truly circular economy. The question is where and how to prioritize. As a rule of thumb, a strategy that is higher up the ladder generally requires fewer material resources or processing steps and therefore causes less environmental pressure.

- The R-strategies at the top of the ladder (Refuse & Rethink; Reduce) decrease the total use of material resources (narrowing the loop), thereby massively reducing resource dependency and supply chain risk. Redesign requires high-level skills but will require innovation and result in associated economic wins.
- Those halfway down the ladder (Reuse & Remanufacturing; Repair) postpone the demand for new material resources (slowing the loop) but have the potential to create meaningful midlevel jobs.
- Finally, Recycling is aimed at closing the cycle of materials (closing the loop). A focus on recycling might be needed to reduce major environmental risk or already existing pollution in the short term. Invention of new recycling technologies will also create jobs and boost innovation. However, we should not forget it is low on the ladder and often requires a lot of energy and some influx of virgin material.

Another helpful way of prioritization is to look at certain societal domains, for example: plastics, manufacturing, construction and buildings, transportation and food & beverages. In certain settings, other domains will be prominent. For example, waste management and/or tourism for island economies, or in emerging economies, primary resource processing. Each domain will have its own specific problems. Supply chain risk might be big in manufacturing, while different types of pollution (to air, water, land) is likely to be a major driver in others. The transition to a circular economy is a cluster of domain specific transitions. Each domain, or

subdomain will have different goals and transition speeds, so different domain specific goals and processes are needed. This realization will help define certain specific priorities and boundaries between domains, while always keeping in mind that these boundaries are permeable. Just think of how intertwined the food & beverage industry is with plastics use and litter, including plastic soup.

Defining Circular Economy for Your Situation

The first step is about outlining a clear definition that is not only workable, but also rings guidance and inspiration for all involved in the project at hand. One research paper found 114 different definitions and associated interpretations of Circular Economy.⁴

"Our findings indicate that the circular economy is most frequently depicted as a combination of reduce, reuse and recycle activities, whereas it is oftentimes not highlighted that CE necessitates a systemic shift. We further find that the definitions show few explicit linkages of the circular economy concept to sustainable development. The main aim of the circular economy is considered to be economic prosperity, followed by environmental quality; its impact on social equity and future generations is barely mentioned. Furthermore, neither business models nor consumers are frequently outlined as enablers of the circular economy." (Kirchherr, et al. 2017)

The most useful definitions seem to be more contextual and are often quite long and descriptive, not dissimilar to the text provided in this paper above (insert section number). Here is another example:

"Unlike the current economy, which is largely based on the principle "take-make-waste" (linear economy), the focus point in a circular economy is to not unnecessarily destroy resources. This implies far more than the reduction of waste through recycling, stresses the following focal points: reducing the consumption of raw materials, designing products in such a manner that they can easily be taken apart and reused after use (eco-design), prolonging the lifespan of products through maintenance and repair, and the use of recyclables in products and recovering raw materials from waste flows. A circular economy aims for the creation of economic value (the economic value of materials or products increases), the creation of social value (minimization of social value destruction throughout the entire system, such as the prevention of unhealthy working conditions in the extraction of raw materials and reuse) as well as value creation in terms of the environment (resilience of natural resources)." ⁵

⁴ Kirchherr Julian, Reike D., Hekkert M. 2017. Conceptualizing the circular economy: An analysis of 114 definitions. *Resources, Conservation & Recycling* 127 (2017) 221–232

⁵ From *Towards a Circular Economy: The Role of Dutch Logistics Industries and Governments* Buren van Nicole, Demmers M., Heijden van der, R. and Witlox F., MDPI, *Journals Sustainability* Volume 8 Issue 7 10.3390/su8070647

The point here is that a predefined succinct, one-size-fits-all, global definition of circular economy does not make sense. A definition, will have to be contextual, culturally sensible and, therefore, related to place. The importance of PLACE (wherever you - the reader- are) is paramount. We need to bring awareness to small scale local processes, that may well already exist, as part of the re-concentrating dispersed material stocks and all the “Re-” opportunities (see Circular Economy 101) conducted in sync with local, regional, national, social and cultural norms.

In a facilitated stakeholder process various definitions will have to be probed, reviewed and molded into a workable definition that all stakeholders can get behind. Next, once decided on the definition and a set of guiding principles, this will then become the required basis for outlining the vision, plans and objectives for the project at hand. In this way, finding the most fitting description becomes an opportunity to create more locally tailored sustainably circular solutions without a prescriptive imposition of someone else’s rigid definition.

In this age of global stress, "there is a dire need for civil society and consumers, the private sector, as well as the policy framework within which it operates, to align their goals."

Corvellec, et. al., 2021

What are guiding principles? Again, these will have to emerge from the stakeholder process. They are not black and white, but rather pathways with a goal we work towards. Again, both wisdom and high-end stakeholder facilitation skills are needed. Here are some suggestions for possible principles:

- All energy we use comes from the sun (ie. we strive to use only clean energy),
- There is no waste. Everything is intentionally designed so it can be 'food' for another process or composted toward soil amendment,
- Our soil, water and air are healthy (sustainability goals),
- People involved are content and inspired by opportunities, and so will their children,
- We carefully take into account what the region where we work needs,
- Add your own according to your contextual and local needs.

The Circular Economy Roadmap

The logical step toward implementation is typically a circular economy roadmap. In fact, the text above is intended to lay the groundwork for such a roadmap, by getting clear on definition, domain(s) and boundaries.

A circular economy roadmap is a workbook for change: it helps define the required steps and compiles key stakeholders’ views on the essential changes and actions required for the circular transformation. It includes a vision as well as goals. Shifting to a circular economy requires a

long-term effort, so people will come and go as a result of changes in appointments or careers. A roadmap helps to lay out the necessary steps and timetable so progress can continue.

A circular economy compiles the key stakeholders' views on the essential developments and creates shared understanding on the steps that are needed. It also defines the roles of each stakeholder and their responsibilities and actions. The roadmap is a combination of strategy and action plan, and defines the parameters to be tracked to demonstrate progress.

Over and above, a transition toward a sustainable circular economy is a process of people that need to work together. Therefore, cooperation, trust, ownership, flexibility, adequate financial means and even enthusiasm are essential. These soft attributes need constant work, as does the contribution of harder skills, tools, wisdom and experience. (Examples of 'tools' include legislation and regulations, market incentives, monitoring, knowledge and innovation, and producer responsibility.) As such, careful and skilled facilitation, combined with transparent monitoring is a must to avoid failure.

It is not the intention of this document to lay out the process in detail. There are several regions and countries that have developed circular economy roadmaps. Circularity Edge can provide additional guidance.

An Evolved Mode of Leadership is Required

Because the circular economy framework requires a new way of thinking (as per the Einstein quote used in the first section) it will not only require new ways of communication, dissemination and associated education and training, but it will also require a new type of leadership. Bringing in climate and biodiversity concerns may seem complicated at first, but expanding one's scope and perspectives to include "systems" will help us master new adeptness for spotting risk and taking a more complete picture into account. From a more advanced perspective we can more precisely focus on the tasks at hand.

Today's exemplary leaders will use ego as a tool, a role to play, yet not identify with their ego. They will show active involvement in the comprehensive transformation of the organization and of society; concern for authenticity, truth and transparency; complex and hold and integrated vision. Below are some attributes that we have been able to identify:

- Transformational; flow with the evolving nature of internal and external processes and people,
- Radical integrity, authenticity
- Self-knowledge, through self-inquiry and reflectiveness,
- Ability to hold different perspectives,
- Curiosity, listening skills,
- Culturally sensitive and communicate to people where they are at,
- Consciously use vulnerability, vigilance and strength,

- Live your (and the company's) principles and practice radical authenticity,
- Connect agendas and people,
- Collaborative leadership,
- Juggling the above, hold the mission at the center, be purpose driven and keep your focus, especially if you run an SME,
- Trust, yet measure and monitor,
- Wield the sword to perform any cuts necessary with precision and compassion.

The Circular Economy is the way of the future. Simply because the old linear way does not work anymore. We trust that this paper helps to demystify the framework and provides a honest and clear view of the challenges and benefits that this framework can bring to business, communities and our common future. This paper was finalized during COP26 in Glasgow. The world community now is openly speaking about the pressing dangers the world faces in terms of climate change. You now understand that circular economy has to be integrated into climate mitigation solutions and vice versa, as do social issues related to human rights, labor rights, supply chain risks, public relations risks, etc. This paper does not sugarcoat the circular economy as an easy fix. It makes you aware of the pitfalls of starting out without proper understanding and preparation and it offers guidance on where and how to get going. The time to start is now.



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For further information or questions contact the lead author, Michiel Doorn

Email: michiel.doorn@circularityedge.com

Phone: +1 919 396 9971

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Circularity Edge, LLC.

www.circularityedge.com

Rhode Island, United States

