Circular Economy: Better Design from Start to ... Start

"Circularity" is about more than just recycling. It means building and buying things only when necessary—and without wasting anything.

by P.J. Melton and Elizabeth Waters

global economy has become more and more linear, meaning that building products, and even whole buildings, follow a one-way trajectory: resource extraction, then use, then disposal.

This model boosts short-term profits, but it relies on fast and cheap manufacturing to do so, which can directly harm people and planetary systems. The World Green Building Council (World GBC) has criticized the linear model because it:

1. **Uses up finite resources**—for example, non-renewable petroleum gets made into single-use water bottles.
2. **Emits greenhouse gases** as we dig up raw materials, truck things from place to place, manufacture and use products, and then dump whatever's left in a landfill.
3. **Exploits and contributes to inequality and human rights violations** through unchecked air and water pollution, corporate land grabs, and unfair or even forced labor practices.

The linear economy also sends a lot of valuable "waste" to landfills: most cheaply manufactured things are less expensive and easier to throw out than they are to reuse or repair.

What would a circular economy be like?

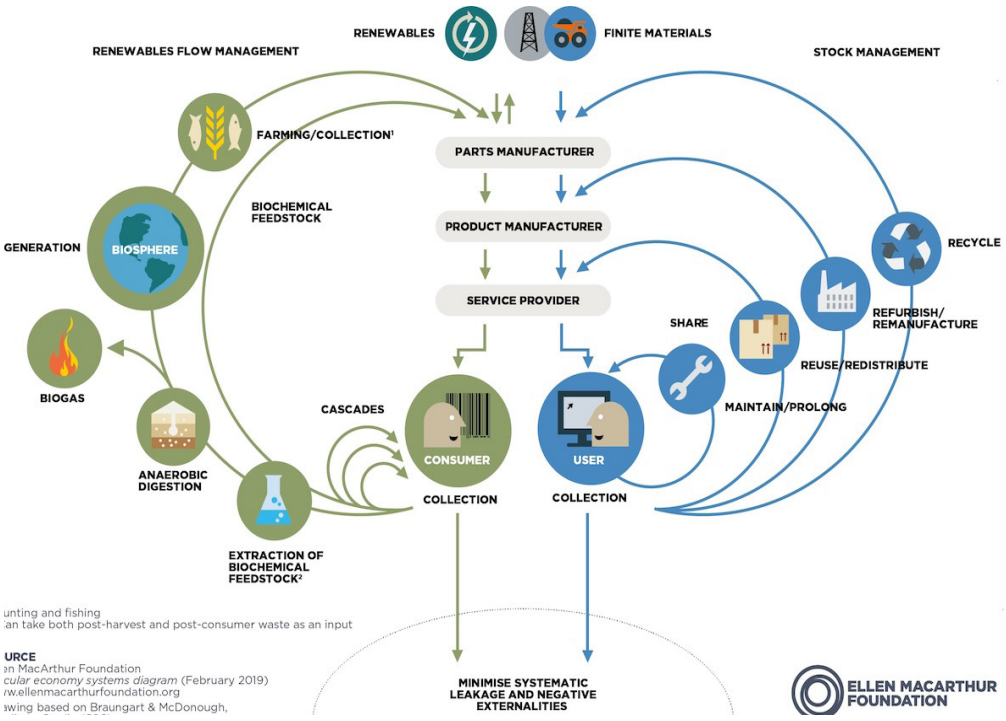
In a circular economy, resources are instead reused as long as possible before fed back into the original system that produced them, according to the Ellen MacArthur Foundation (EMF). A circular model would leave more land, more communities, and more ecosystems untouched. And it would reduce the embodied carbon of materials.

Circularity also requires—and contributes to—social equity and material health: a circular system needs fewer raw material inputs and, to prevent the recirculation of toxic chemicals, avoids using most of them. A widespread circular economy would also promote more equitable treatment of people and communities, protecting them from pollution as well as from the disruption and displacement associated with resource exploitation and climate change.

The cycle starts with better design solutions

Circularity, as initially envisioned in the 2001 green building classic *Cradle to Cradle: Remaking the Way We Make Things*, written by William McDonough and Michael Braungart, necessarily begins before product and project design. That's because the way we put materials and components together determines how readily they can be reused. For example, using nails, pegs, or screws instead of adhesives makes it easier to deconstruct buildings and reuse their components rather than demolishing them.

For this reason, McDonough and Braungart have spoken of two distinct "cycles" of material use and reuse—biological



The Ellen MacArthur Foundation's "Butterfly Diagram" depicts the biological and technical cycles that are foundational to a circular economy. The overarching goal of both is to preserve the value of products and materials for as long as possible and then feed them back into their respective cycle.

and technical. The overarching goal for both cycles is to capture the most value from every material and product throughout its life and then feed it back into its respective cycle.

That becomes much harder if you blend material types—for example, natural and synthetic threads woven together in a textile are nearly impossible to tease apart. Keeping biological and technical cycles separate is fundamental to circularity.

The biological cycle

EMF has elaborated on the original cradle-to-cradle concepts, explaining on its website that biological products—biodegradable materials, such as wood and agricultural products—go through a series of cascading loops. First, they are used as long as possible at their highest value, then their next-highest value, and their next, until they are no longer usable. At this point, they can fuel regeneration, where the biological material breaks down, and its nutrients return to nature.

This regeneration only works correctly if the original biological materials contain no toxic chemicals and are easily separable from any non-biological materials.

The technical cycle

Non-biodegradable materials, like metals, minerals, and plastics, go through the technical cycle. They can't be fed back into an ecosystem, but they can be recirculated in other ways, the EMF website explains.

A technical material's highest value comes from durability: it can be maintained, shared, and reused. Once a product is past its useful life, refurbishing or remanufacturing it is the best way to retain its value. Finally, when a product can no longer be reused, refurbished, or remanufactured, its components can be

recycled.

Recycling is a last resort. Although it's preferable to throwing things in landfills, it's also far more resource intensive and preserves far less value than the other phases of the technical cycle (let alone the biological cycle).

For a circular economy to be feasible and cost effective, products, buildings, and infrastructure must be designed for eventual disassembly and material recovery. Realizing that vision will likely require governments to provide or encourage financial incentives.

How can project teams support a circular economy?

According to WorldGBC, a circular building is adaptable and resilient and is easy to maintain, reuse, and disassemble. It minimizes waste throughout its lifetime by leaving out unnecessary materials and by including products that are durable and maintainable.

WorldGBC calls on building owners, developers, designers, and contractors to:

- Reuse entire buildings when feasible.
- Optimize the design to limit the need for extra products and materials.
- Design for adaptability, disassembly, and regeneration.
- Specify reused or alternative materials.
- Minimize construction waste.
- Develop procurement policies that prioritize circular principles.

Such policies often prefer products that are certified at the Silver level or higher under the Cradle to Cradle (C2C) system, originally created by McDonough and Braungart in 2005. The current version of this program verifies a product's performance in five key categories:

- Material Health
- Product Circularity
- Clean Air and Climate Protection
- Water and Soil Stewardship
- Social Fairness

To achieve a circular economy, circularity strategies must be adopted at every stage of a building's life cycle. And, like any other collaborative effort, the success of such strategies will hinge on effective upfront planning, ongoing data collection and optimization, and feedback loops between project stakeholders.

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