Putnam INVESTMENTS

April 2022

Toward a circular economy

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Toward a circular economy

The global economy as it currently operates demands more of the world's resources than Earth can sustain. This challenge summons adaptations and new solutions. Among these, the concept of a circular economy, which maximizes effective use of resources and minimizes waste, has emerged as an important framework to inform business leaders and investors.

The circular economy offers potential to improve planetary health and to dramatically improve the natural resource intensity of the global economy.

Human production and consumption have already exceeded Earth's capacity to provide and replenish natural resources in key areas, due in large part to linear "take, make, waste" approaches to production, consumption, and disposal.

These linear approaches are linked to high levels of emissions, waste, and other environmental challenges, as well as increasing business risks and uncertainties.

In contrast, circular economy approaches focus on effective design; extended product life spans through reuse, repair, and recycling; and more benign decomposition.

These circular approaches have direct links to new products, practices, and business models, offering possibility in some settings for enhanced growth, reduced risk, and improved financial returns.

Investors have the opportunity to identify successful business innovations in this area, with potential for strong growth, attractive returns, and environmental benefits.

Understanding the fundamental operating context for specific companies, products, and production processes improves this analysis.

Companies that are pursuing circular economy strategies include **Ball Corporation, Eastman Chemical, Levi Strauss, Lyft, United Rentals, Apple,** and **ASML.**

We are glad to share these observations from Putnam's Sustainable Equity team, as we work to assess the vital developments in this area.

Specific company examples: Company examples are intended to help illustrate Putnam's research process and should not be considered a recommendation or solicitation to purchase or sell the securities. Current investment themes and company examples were selected without regard to whether such themes, or relevant securities, were profitable and are intended to help demonstrate the investment process. The securities mentioned are not necessarily held by Putnam for all client portfolios. It should not be assumed that any investment in these securities was, or will prove to be, profitable, or that the investment decisions we make in the future will be profitable or equal to the investment performance of securities referenced herein. As with any investment, there is a potential for profit as well as the possibility of loss. A security may be selected for the portfolio based on factors other than the sustainability themes, metrics, and characteristics highlighted herein, and the analysis is not intended to be relied upon as a forecast or investment advice, and is not a recommendation, offer, or solicitation to buy or sell any securities or to adopt any investment strategy.

All research on the circular economy is as of April 2022, the date of this report's original publication.

Circular economy resources

Our research on the investment implications of the circular economy has benefited tremendously from the work of many others, including these leading organizations:

Stockholm Resilience Centre

Ellen MacArthur Foundation

The Biomimicry Institute

Platform for Accelerating the Circular Economy (PACE)

World Resources Institute

Intergovernmental Panel on Climate Change (IPCC)

Putnam's approach to sustainable equity investing

Our research process for Putnam's sustainable equity strategies focuses on the links between sustainability and long-term business fundamentals. Specifically, we seek to identify companies whose businesses are made stronger by their commitments to relevant sustainability issues. Our strategies invest in companies whose financial performance benefits from their demonstrated leadership in sustainability issues that are financially material to their businesses or because their products and services provide solutions to essential sustainability challenges.

Putnam sustainable equity framework

Leadership is:	Solutions are:
MATERIAL *Is the sustainability leadership relevant to long-term business success?*	**NEEDED** *Is the solution contributing to a thriving world?*
PROACTIVE *Does the activity go above and beyond compliance or sufficiency?*	**IMPROVING** *Does the solution offer meaningful benefits vs. prior options?*
PROGRESSING *Is reporting transparent and analyzeable? Can we chart progress over time?*	**ADVANCING** *Are the positive impacts increasing over time?*
EFFECTIVE *Can we identify meaningful positive impact both for the company and beyond?*	**EFFECTIVE** *Can we identify meaningful positive impact both for the company and beyond?*

SECTION 1

Why is the circular economy important, and why does it matter for investors?

The circular economy is one of the most far-reaching frameworks for the development of sustainable solutions, with significant potential to generate environmental benefit, economic value, and business innovation.

There is strong scientific consensus regarding the deteriorating health of the planet and the seriousness of climate change.[1] Human consumption and production patterns have had significant impact on planetary health and have already exceeded Earth's capacity on several important dimensions.[2] Current rates of resource use would require approximately 1.75 Earths to maintain healthy ecosystem functions and regenerate needed resources.[3] Consequences of climate-related risks like extreme weather, drought, and storms have an amplified impact on economically disadvantaged communities, increasing inequities of health and wealth.[4]

Against this sobering backdrop, the circular economy offers potential for valuable and vital improvements. As Dame Ellen MacArthur notes, "If we can get to an economic model that is restorative and regenerative . . . we have an economy that can run forever."[5]

More than 100 billion tons of resources enter the economy every year, from metals, minerals, and fossil fuels to organic materials from plants and animals.[6] Of this, just 8.6% gets recycled and used again.[7]

The utilization of resources has tripled since 1970 and could double again by 2050 if "business as usual" continues.[8] Importantly, resource use continues to outpace population growth, despite economies of scale in some settings, improvements in certain recycling rates, and rapid growth of the service economy.[9] This implies the overall material intensity of economic growth worldwide remains high and that most businesses are still relying on more linear "take, make, waste" models.

Adapting business models to be less resource intensive creates opportunity for tremendous environmental and economic benefit.

+100B tons

of resources enter the economy every year

Just 8.6%

is recycled and used again

Linear business model

This linear approach is analytically tidy and familiar to many who have studied neoclassical economics. But it stands in clear contrast to all we know about the more complex and interconnected real-life structures of networks, ecosystems, and social structures — the essential systems that support and influence most long-term business results.

Source: Ellen MacArthur Foundation.

SECTION 2

What is the circular economy?

A healthy planet supports all human activity, but the degradation of natural systems is becoming more evident. As a potential solution, the "circular economy" refers to an economic model that emphasizes cycles of reuse, recycling, and repair versus a linear model of extraction, consumption, and disposal.

In a circular economy, products are designed with goals of efficient resource use, extended product life, and improved ability to repair, recycle, and reuse materials. Pollution and waste are minimized, products and materials are used longer, and natural systems are more able to maintain health and regenerate. While some of these design challenges are significant, a circular economy approach presents tremendous potential for economic growth to be decoupled from ever-increasing natural resource use, including the related negative impacts on environmental and social systems.

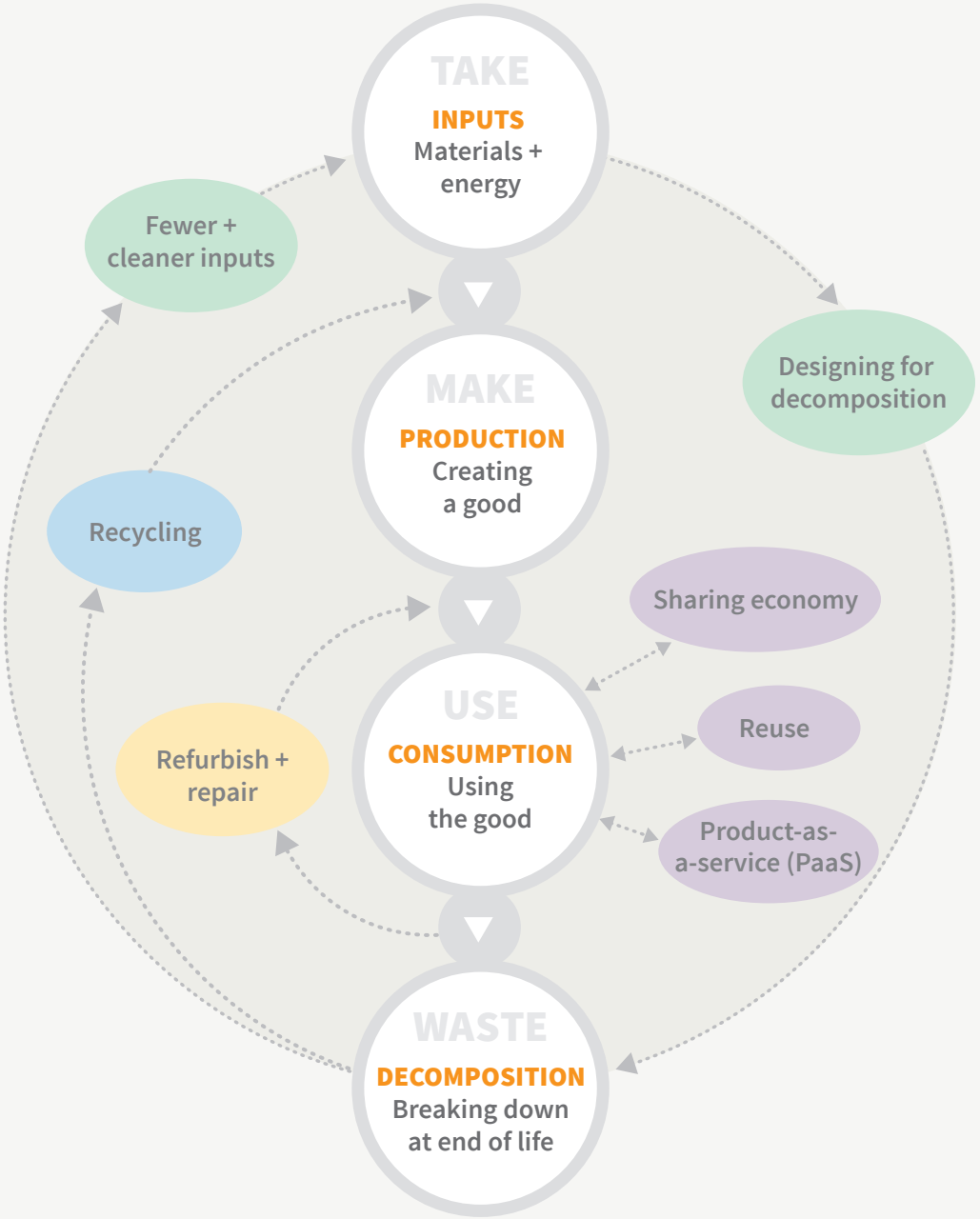
Within the context of increasing resource constraints, global warming, and still-rising worldwide demand, circular economy design principles and business structures offer immense opportunities for the creation of new processes, practices, and businesses with meaningful benefits. The Platform for Accelerating the Circular Economy has identified 21 key solutions that offer potential to decrease resource extraction by 28% and to improve greenhouse gas emissions by 39%.[10]

Circular economy

While the circular economy is often presented as a single loop, as fundamental analysts, we aim to understand all parts of business models. Therefore, we find it is helpful to illustrate the "circles within the circle" to uncover more functionally specific insights. For example, before a product is even created, we can design for modularity, reuse, and ultimate decomposition. Sharing economy solutions, rentals, and resale offerings focus on extending the useful life of products within the consumption phase. And repair and recycling practices create different flows between the inputs phase and ultimate decomposition or disposal, lowering ongoing use of raw materials and waste rates.

Circular economy model

The circular economy offers multiple intervention points to improve resource use and minimize waste through thoughtful design and production, extended product and component uses, and more benign decomposition.



Sources: Putnam Investments, Ellen MacArthur Foundation.

SECTION 3

Evolving business models

Business leaders are recognizing the opportunities that circular economy approaches can present. These opportunities vary across different business types, so understanding business fundamentals can help investors to identify the areas of greatest potential benefit.

When we begin to translate from a systems-level understanding of the circular economy to specific business models, patterns emerge that help to improve our analytical understanding.

For many businesses, in the short term there is still a disconnect between market price and the true cost of inputs, waste rates, and environmental consequences, due to separations across time and space. In a world of infinite forests, recycling cardboard might appear complicated and costly. In a world of infinite affordability, even rarely used equipment might warrant plenty of customers.

However, business innovation around circular economy principles is accelerating as the finite supply of raw materials, the long-term costs of waste and toxicity, and the interconnections between economic, environmental, and social systems become more apparent. Increasingly, business leaders are recognizing the systemic risks and opportunities that impact their operations, such as potential inflation, materials scarcity, elevated operating costs, and higher long-term liability.

Consequently, companies are decreasing reliance on raw materials, designing better for repair and reuse, and creating new business models that allow them to benefit from extended product lives. Importantly, these developments are not only risk management exercises; they are also creating opportunities for innovation in products, services, and processes, along with potential financial returns.

Before diving into some specific examples of business evolution, it's important to note several universal ideas that go beyond any particular product or process. As students of complex adaptive systems and the field of biomimicry, we observe several key design principles that are embodied in natural systems and deeply embedded in the concepts of circular economy. Biomimicry luminary Janine Benyus observes, "The answers to how to live sustainably on our planet are all around us . . . we are not the first to manufacture. Life solves its problems with well-adapted designs, life-friendly chemistry, and smart material and energy use."[11] It is easy to observe the contrast between these descriptions of natural systems design and many common business practices.

> “The answers to how to live sustainably on our planet are all around us … we are not the first to manufacture. Life solves its problems with well-adapted designs, life-friendly chemistry, and smart material and energy use.”

JANINE BENYUS
Co-founder, Biomimicry Institute

Use less. Natural systems illustrate an approach that is material and energy efficient. A honeycomb creates the most usable space with the least materials intensity. A squirrel stores enough nuts for the winter, not all the nuts she can find.

Use clean. Natural systems use “clean chemistry,” where components return back into usable raw materials at the end of their lifecycles. There are no landfills in a meadow or toxic waste sites in a forest.

Use smart. Natural systems make the most of modular components, integrating development and growth. Ants build out the colony structure as population grows. Trees branch above as their roots stretch below. When any one portion is disabled or out of sync with the whole, it can be repurposed or recycled without ruining the rest.

Adjust, adapt, evolve. Natural systems are attuned to their local environments, changing over time as conditions warrant. Sunflowers follow the arc of the day, and wildebeests follow the rains. Feedback loops are robust, and resilience is embodied through variation and diversity, redundancy, and decentralization.[12]

These universal principles are relevant across almost all business settings, and we can see evidence of these strategies in a wide range of companies and products.

More specifically, we identify three major types of production models, as detailed in the following table. While there are considerable connections between these categories, each type of production model lends itself to a particular form of solution. Products that are derived primarily from raw materials can benefit from a focus on recycling. Products that are more complicated, involving high energy and high materials intensity, can benefit from a focus on extended product life. And highly engineered technological products can benefit from a focus on modular design, repair, and reuse. All of these forms of innovation offer opportunities for investors to identify corporate leadership and solutions providers, the key focus areas for the Putnam Sustainable Leaders and Putnam Sustainable Future portfolios.

Production process	High raw materials content	High resource + energy intensity	High complexity
Challenges	High ecosystems impact; risk of long-term raw materials scarcity; costs linked to commodity pricing	High exposure to energy and materials costs; high exposure to inflationary pressures	Rapid obsolescence/short product lives; difficult to recycle; reliance on rare materials
Product examples	Aluminum, steel, glass, paper/ cardboard	Textiles, capital equipment, building materials	Technology-based hardware
Circular economy focus	Reuse of raw materials	Increase useful life of products	Repair of finished products; reuse of components
Solution form	Recycling	Shared use and resale	Repair, reuse
Requirements	Efficient recycling systems; fair price vs. value of raw materials	New product-as-a-service business models; effective logistics	Design for reuse; market development for reused products.
Opportunities	Lower exposure to commodity spikes or shortages; higher customer demand for recycled materials	Less cyclical business models; cost effectiveness for customers	More control of key inputs; less risk of supply scarcity
Company examples	Ball Corp; Eastman Chemical	Levi's; Lyft; United Rentals	Apple; ASML

SECTION 4

Evolving production models

The three types of production models described here can be found across a range of sectors and products, and we can identify a number of companies whose strategies illustrate circular economy practices. In many cases, these practices are in the early days of their development, with opportunities to extend their scope and improve their environmental and financial effectiveness over time.

Packaging materials

Packaging materials like boxes, bottles, and cans are examples of products with high raw materials content where a recycling-focused business model can have meaningful impact. Paper and paperboard, plastics, glass, and metals together represent almost half of all municipal solid waste in the United States, and packaging and containers alone represent about 28% of total waste volumes.[13]

Within this area, aluminum packaging presents some important attributes that differentiate it from other materials. Aluminum beverage containers have a recycling rate of nearly 70% globally and 50% in the United States, and the average aluminum can contains at least 70% recycled content.[14] The physical properties of aluminum are major contributors to these high rates: it is lightweight and therefore relatively easy to transport and maintains very high material integrity when recycled. This compares with more limited material properties for plastics, where most recycled content needs to be downcycled into less-valuable products. This is one key factor leading to lower recycling rates of approximately 9% for plastics.[15]

Ball Corporation is a company that has focused its corporate strategy on aluminum packaging and its attractive recycling profile. In 2021, 86% of Ball's revenue was generated from the sale of products that are manufactured with recycled materials, are reusable, or recyclable, including aluminum beverage cans, bottles, cups, and aerosol cans. These sustainability attributes are increasingly important to Ball's customers, which is contributing to revenue growth, and the use of recycled material has potential long-term cost benefits as well.[16]

Ball Corporation is a company that has focused its corporate strategy on aluminum packaging and its attractive recycling profile.

Beyond aluminum, many plastics and composites packaging companies are improving the materials they use and the recyclability of their offerings, in part due to strong customer demand.[17] Major packaged goods companies like **Unilever**, **AB InBev**, and **Procter & Gamble** all have major initiatives that focus on increased recyclability, increased use of recycled materials, and broader system change.[18] And major retailers like **Walmart** and **Amazon** have programs with suppliers to reduce total packaging volumes and waste to landfill.[19] **Eastman Chemical Company** has developed a molecular recycling process that allows for recycling of certain plastics that were previously hard or impossible to address through mechanical recycling approaches.[20] Additionally, dozens of new approaches to packaging using biomaterials like mycelium and cellulose offer potential for future advancement. All of these innovations have potential to align with rising demand and benefit from improving economics over time.

Fashion and textiles

Textiles and fashion are examples of products with high resource and energy intensity, where extending product lives can have a meaningful environmental and economic impact. Business models that focus on long-lasting products, resale, or rentals are all developing quickly.

Textile creation is responsible for an estimated 10% of global greenhouse gas emissions, and just 12% of material used for clothing is recycled. About 60% of textiles are made using fossil fuel-based synthetic fibers like polyester, and natural fibers like cotton are very water intensive to produce.[21] The average closet in the United States is estimated to contain about 25 unworn items, and the average clothing item is worn just 7 to 10 times before being discarded.[22] This backdrop presents an opportunity to decrease unworn items, extend use of existing items, and divert waste from landfill through repair, reuse, and resale.

Levi Strauss is an example of a company whose brand focuses on durability and long-term appeal, as opposed to many "fast fashion" approaches. More recently, the company has become more active in resale and repair offerings, including its SecondHand vintage resale marketplace. Levi's also has made significant investments in improving materials and resource intensity for its products, contributing to improved profitability and better environmental impact. For example, the company's cottonized hemp material requires less water and fewer pesticides, making the finished products about 20% less water intensive.[23] Though these newer businesses and product offerings are still small, they have potential to engage customers, create new revenue streams, and improve overall environmental impact for the products involved.[24]

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A number of fashion and textile companies are focused on improvements in their product sourcing, from both an environmental and social standpoint. For example, **H&M** has committed to 100% recycled or sustainably sourced materials by 2030, and **Allbirds** highlights its materials integrity as a core product attribute.[25]

Additionally, a range of fashion resale and rental businesses have developed to meet rising demand, including **thredUP**, **Poshmark**, **Depop** (owned by **Etsy**), **Rent the Runway**, and **The RealReal**. In addition to improving the overall volume of textiles in circulation, buying secondhand reduces the carbon footprint per item by 82%, while extending product life and usually offering more affordable options for consumers. While some of these businesses have not yet reached profitable operating models, the secondhand fashion market is expected to double in the five years ending 2025, and 33 million consumers bought secondhand for the first time in 2020, indicating strong and growing demand. Additionally, technological advances can make these models less labor and cost intensive, improving long-term economic prospects.[26]

Capital goods

Capital goods like cars and commercial equipment are examples of products with high resource and energy intensity where extending product lives can have a meaningful environmental and economic impact. Business models that focus on product-as-a-service, rentals, and shared use are all developing quickly.

Equipment manufacturing of all sorts consumes over 7 billion tons of raw materials globally each year, and the demolition of long-lived assets represents 23% of global waste annually.[27] Additionally, many types of capital goods are not in constant use. For example, the average passenger car sits idle 95% of the time, and many types of heavy equipment and specialized tooling are subject to long periods of downtime due to inconsistent need or unexpected repair and maintenance requirements.[28] The materials intensity, cost of ownership, and underutilization of capital equipment all present opportunities for more effective use of these assets.

Ridesharing companies like **Lyft** and **Uber** are examples of companies that are creating businesses centered around more effective use of capital equipment. A car used for rideshare services travels three to five times as many miles annually as a typical personal vehicle, and availability of rideshare services is estimated to have decreased overall individual car ownership in North America by as much as 9 million units.[29] Though the early stages of these businesses' development have raised important questions about congestion, safety, and employment models for drivers, these metrics on auto ownership and use indicate that ridesharing could result in significantly lower need for individual auto ownership over time. If so, we could see more dramatic improvements in utilization of those resources, decreasing resource use for auto production and production-related emissions while potentially
enhancing convenience and total cost of transportation for customers.

Availability of rideshare services is estimated to have decreased overall individual car ownership in North America by as much as 9 million units.

Equipment rental companies like United Rentals and Ashtead also offer more effective fleet utilization for everything from scissor lifts to specialized power tools. Rental models allow the equipment to be used more frequently and maintained more consistently, offering customers cost savings, ease, improved safety, advanced features, and greater access to the equipment they need.

Shared service business models are proliferating beyond traditional capital goods as well. Airbnb and VRBO (owned by Expedia) offer similar services for short-term housing and travel, while cloud computing companies like Microsoft Azure, Amazon AWS, and Google Cloud Platform provide computing access on an as-needed basis. In all of these cases, the more effective use of long-term, capital-intensive assets is a key contributor to the economic success of the businesses.

Electronics

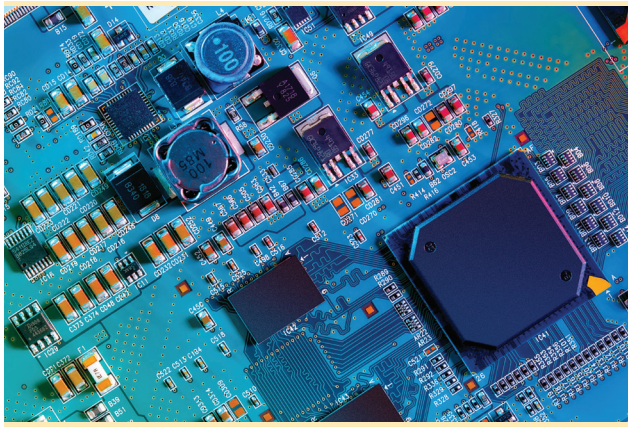
Electronics are examples of high complexity products that rely on rare materials, are difficult to recycle, and often have useful product lives that are relatively short. For these types of products, improving repair and reuse practices can have significant environmental and economic impact. Business models that focus on design for reuse or modular recovery are advancing, offering opportunity for risk mitigation and improvements in potential long-term financial returns.

Electronics are less materials intensive than some other product types, but the profile of those materials is both costly and risky. E-waste represents 2% of municipal solid waste but makes up 70% of the hazardous waste in landfills, including mercury and flame-retardant chemicals. The value of e-waste is estimated to be about $62 billion annually, mainly in metals like copper and gold, though this value could be much higher if the materials involved remained embedded in usable components. About 20% of electronics are recycled globally; this relatively low rate is due in part to recycling processes that are complicated and require a range of expertise and infrastructure.[30]

This backdrop implies tremendous potential value in extending capacity for electronics repair and reuse, both at the finished product level and at the subcomponent level. To pursue these opportunities, business processes for product design, product lifecycle management (including modular components and service models), and refurbishment potential are all important.

A number of hardware companies have developed serious strategic approaches to product circularity, including Apple, which has accelerated product buyback programs and pledged to use 100% recycled materials by 2030, a very ambitious target. For example, the iPhone 13 already uses 98% recycled rare earth elements and 35% recycled plastic.[31] In addition to clear environmental benefits, these investments could help Apple to mitigate risks of supply shortages and cost increases, and they open new avenues for offering customers service-based offerings instead of (or in addition to) hardware-based offerings.

ASML, a leading provider of semiconductor manufacturing equipment, uses modular design and an active focus on service and refurbishment to support high levels of productivity and long useful life of equipment, two attributes that are vital to their customers. Because of this focus, 90% of all ASML systems ever made are still in use; the company has a 77% recycled materials rate; and new offerings can certify restored components at “as new” quality levels. All of these elements lead to improved environmental intensity, ability to offer productivity-based contract terms to customers, and related financial benefits for both ASML and its customers.[32]



ASML uses modular design and an active focus on service and refurbishment to support high levels of productivity and long useful life of equipment.

Circular economy opportunities for high complexity products are not limited to the technology sector. Health care equipment companies like **Philips** have developed combined product and service models for imaging systems like MRI equipment, where the company manages equipment repairs and maintenance, allowing for better alignment of interests between producer and customer. When aircraft are retired for **Boeing**, **Airbus**, and related companies, over 90% of the overall content is reused or recycled throughout the system of suppliers, manufacturers, and customers. Approximately 40%–50% of this value is in highly technical components that can be repaired and reused.[33]

Conclusion

The circular economy offers potential to enhance planetary health and to dramatically improve the natural resource intensity of the global economy.

Business approaches that focus on effective design; extended product life spans through reuse, repair, and recycling; and more benign decomposition have the opportunity to reduce risks, improve environmental outcomes, align with customer demand, and potentially enhance long-term prospects for growth and financial returns.

Investors have the opportunity to identify successful business innovations in this area by better understanding current resource intensity of key products and processes, recognizing areas for potential solutions, and analyzing individual company efforts to contribute to the circular economy.

Beyond all these strategic and tactical benefits, focusing on the circular economy is a way for investors and business leaders to realign our activity with the needs of the world we inhabit. As more effective stewards of the long-term health of our systems, societies, and planet, we can reconnect investing with the world it is intended to serve, helping to create conditions for all to thrive.

The circular economy is a key theme within Thriving Planet, one of the major categories represented in our Investing for a Thriving World map. All the themes represented here inform our fundamental research, and in turn are informed by emerging trends observed in our company-specific analysis. This forward-looking framework contributes to our investment decision-making, as we seek companies that are strengthened by leading or providing solutions in essential sustainability areas.

Solutions for acute needs
Treatments for chronic conditions
Telemedicine and digital access to care
Data-driven diagnostics and treatment
Home-based care
Team-based holistic care

Delivery of care

Genetic therapies
Plant-based medicine
Non-invasive diagnostics and therapies
AR and VR therapies
Robotics
Connected devices
Syn bio drug development
Data aggregation and analytics

Tools and therapies

Food and nutrition
Exercise and fitness
Mental, emotional, spiritual wellness
Healthy relationships
Sleep and rest
Public health infrastructure

Preventive care and wellness

Thriving People®

Human health and well-being

Environmental health

Thriving Planet®

Renewable and decarbonized energy
Energy storage
Carbon capture and sequestration
Climate and energy analytics
Carbon value and pricing mechanisms
Electrification of end products

Decarbonization

Resource stewardship

Regenerative land use
Biodynamic practices
Seed traits improvement
Natural crop treatments
Precision agriculture
Irrigation solutions

Sustainable agriculture

Proteins, microbes, enzymes, fungi
Bioengineering
Biomaterials
Bioenergy
Natural ingredients

Biological solutions

LEADERSHIP IN IMPROVING:
Greenhouse gas emissions
Materials intensity
Water use
Soil health
Biodiversity and ecosystems health
Responsible sourcing


Cloud computing
Analytics and connectivity
Shared transportation
Shared real estate
Shared manufacturing
Rental-based businesses
Automation, sensing, and repair
Precision agriculture
Custom design and manufacturing
Advanced computing technologies
Additive manufacturing
Logistics solutions
Transport and distribution
Packaging innovation
Digitization
Flexible production
Productivity and quality tools
Services supporting SMBs
Shared infrastructure
Precision technology
Business processes
Efficiency and effectiveness
Thriving Public®
Equity and access
Stakeholder wellness and equity
Access and opportunity
Security and privacy
LEADERSHIP IN IMPROVING:
Employee well-being and work conditions
Supplier standards and stewardship
Value and service to customers
Effectiveness of public policy
Benefit and connection to communities
Diversity, equity, inclusion, and justice
ACCESS TO:
Health care and nutrition
Education and information
Financial security
Meaningful and decent work
Physical safety
Data security
Data privacy
Data use
Infrastructure security
Circular economy
Water quality and access
Materials innovation
Supplier partnerships
Recycling and reuse
Design for durability and decomposition
Testing and monitoring systems
Solutions for treatment and reuse
Improved infrastructure
Irrigation solutions

Endnotes

1 IPCC Sixth Assessment, https://www.ipcc.ch/report/sixth-assessment-report-working-group-i/; https://www.ipcc.ch/report/ar6/wg2/downloads/report/IPCC_AR6_WGII_SummaryForPolicymakers.pdf.

2 Planetary Boundaries, https://www.science.org/doi/10.1126/science.1259855; https://pubs.acs.org/doi/10.1021/acs.est.1c04158.

3 The Footprint Network, https://www.footprintnetwork.org/our-work/ecological-footprint/#:~:text=Today%20humanity%20uses%20the%20equivalent,National%20Footprint%20and%20Biocapacity%20Accounts.

4 IPCC Sixth Assessment.

5 Vogue, "Dame Ellen MacArthur Shares Her Vision of Circular Fashion in a New Book," December 1, 2021.

6 National Geographic, "Here's how a 'circular economy' could save the world," February 18, 2020, https://www.nationalgeographic.com/magazine/article/how-a-circular-economy-could-save-the-world-feature.

7 2020 Circularity Gap Report, https://www.circularity-gap.world/2020.

8 Global Resource Outlook, https://www.resourcepanel.org/sites/default/files/documents/document/media/unep_252_global_resource_outlook_2019_web.pdf.

9 2022 Circularity Gap Report, https://www.circularity-gap.world/2022.

10 2022 Circularity Gap Report, https://www.circularity-gap.world/2022.

11 Janine Benyus, excerpted from remarks at TED Active, 2014, and ESRI, 2018.

12 These summaries are abstracted from materials of the Biomimicry Institute and related writing from Katherine Collins, including The Nature of Investing: Resilient Investment Strategies Through Biomimicry, Bibliomotion/Routledge, 2014.

13 EPA Containers and Packaging Figures, https://www.epa.gov/facts-and-figures-about-materials-waste-and-recycling/containers-and-packaging-product-specific#:~:text=Containers%20and%20packaging%20make%20up,beverages%2C%20medications%20and%20cosmetic%20products.

14 Ball Corporation Sustainability Reporting, https://www.ball.com/sustainability/real-circularity.

15 EPA Recycling Figures, https://www.epa.gov/facts-and-figures-about-materials-waste-and-recycling/national-overview-facts-and-figures-materials.

16 Ball Corporation Sustainability Reporting, https://www.ball.com/sustainability/real-circularity.

17 McKinsey, "The drive toward sustainability in packaging—beyond the quick wins," 2021, https://www.mckinsey.com/industries/paper-forest-products-and-packaging/our-insights/the-drive-toward-sustainability-in-packaging-beyond-the-quick-wins.

18 Unilever Sustainability Reporting, https://assets.unilever.com/files/92ui5egz/production/ea1cbe44628b469752b28c4ab92520bc399dc6d3.pdf; AB InBev Sustainability Reporting, https://www.ab-inbev.com/assets/pdfs/ABINBEV_ESG_2021_Final.pdf; Procter and Gamble Sustainability Reporting, https://us.pg.com/sustainability-reports/.

19 Walmart Sustainability Reporting, https://corporate.walmart.com/esgreport/media-library/document/walmart-2021-esg-annual-summary/_proxyDocument?id=0000017a-82c5-d7dc-ad7a-bac574130000; Amazon Sustainability Reporting, https://sustainability.aboutamazon.com/pdfBuilderDownload?name=amazon-sustainability-2020-report.

20 Eastman Chemical Sustainability Reporting, https://www.eastman.com/Company/Circular-Economy/Solutions/Pages/Mechanical-Molecular.aspx.

21 World Economic Forum, "These facts show how unsustainable the fashion industry is," January 31, 2020, and BBC, "Why clothes are so hard to recycle," July 12, 2020; https://www.weforum.org/agenda/2020/01/fashion-industry-carbon-unsustainable-environment-pollution/ and https://www.bbc.com/future/article/20200710-why-clothes-are-so-hard-to-recycle.

22 Clothing Wear Rate Survey Study, https://censuswide.com/censuswide-projects/barley-and-barnardos-the-fast-fashion-crisis-research/.

23 Stockholm Environment Institute Ecological Footprint Analysis, https://www.sei.org/publications/ecological-footprint-water-analysis-cotton-hemp-polyester/.

24 Levi Strauss Sustainability Report, https://www.levistrauss.com/sustainability-report/consumption/circular-economy/.

25 H&M Sustainability Report and Allbirds 2020 Sustainability Report, https://hmgroup.com/wp-content/uploads/2021/03/HM-Group-Sustainability-Performance-Report-2020.pdf; https://cdn.allbirds.com/image/upload/v1625161698/marketing-pages/Allbirds_Sustainability_Report_2020.pdf.

26 thredUP 2021 Resale Report, https://www.thredup.com/resale/#resale-industry.

27 This figure reflects a broad-based definition of capital equipment, intending to measure all physical hardware, including technological, industrial, and consumer capital goods; Equipment Circular Action Agenda, https://pacecircular.org/action-agenda/capital-equipment.

28 RAC Parking Assessment, https://www.racfoundation.org/research/mobility/spaced-out-perspectives-on-parking.

29 Lyft ESG reporting 2021, https://www.lyft.com/blog/posts/lyfts-2021-esg-report.

30 Electronics Circular Action Agenda, https://pacecircular.org/sites/default/files/2021-02/action-agenda-electronics-feb2021_FINAL.pdf.

31 Apple Product Environmental Report, https://www.apple.com/environment/pdf/products/iphone/iPhone_13_PER_Sept2021.pdf.

32 ASML 2021 Sustainability Report, https://www.asml.com/en/company/sustainability.

33 ICAO Aircraft End-of-Life Best Practices, https://www.icao.int/environmental-protection/Documents/EnvironmentalReports/2019/ENVReport2019_pg279-284.pdf.

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