Assessing Corporate Circular Economy Adoption: Analysis of Fortune 100 Companies' Transition from Linear to Circular Business Models

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Abstract:

This paper presents a comprehensive analysis of Circular Economy adoption among select Fortune 100 companies, revealing critical insights into the current state of corporate circular transformation in the United States. Our research examines 60 major U.S. corporations through the lens of their publicly stated circularity commitments, sustainability reports, and climate impact metrics. The study identifies four distinct corporate archetypes in the journey toward circularity: Circular Transformers (18.3%), Circular Followers (16.7%), Linear Optimizers (36.7%), and Linear Traditionalists (28.3%). Key findings indicate that only 35% of analyzed companies are actively working to transform their organizations from linear to circular models, while 40% have made commitments to circularity with just 5% setting specific target dates. The research reveals a significant gap in product lifecycle responsibility, with merely 5% of companies demonstrating high commitment to product stewardship beyond the point of sale. Additionally, only 41% of companies comprehensively address Scope 3 emissions in their supply chains, highlighting a critical area for improvement in circular transformation. This paper will explore the barriers to adoption, opportunities for innovation, and present recommendations for accelerating the transition to circular business models across different sectors.

Caption: Distribution of Select Fortune 100 Companies Across Circular Economy Adoption Categories (2024)

Introduction and Motivation

In the race towards a sustainable future, the United States stands at a pivotal juncture. The urgent need to understand how America's corporate giants are embracing the Circular Economy has never been more critical.

As the world's largest economy, the U.S. has a responsibility to lead the global transition to sustainable business practices. While progress is being made to move away from a take-make-waste system, there is still significant room for improvement across U.S. firms in fully embracing Circular Economy principles. As the regulatory landscape evolves, consumer preferences shift towards sustainability, and new technologies emerge, American businesses that lead in circularity stand to gain competitive advantages both domestically and globally.

Review of Current Work

Building on INDEED Innovation's previous analysis of Germany's DAX 40 companies, the "USA Circularity Index" is the second version of the "the Circularity Index". This analysis is based on the listed companies 2023 Sustainability Reports, the MSCI ESG Database, and the Net Zero Tracker.

We examined different existing frameworks and literature to understand possible methodologies and derive an easy to use and to compare approach to find a measure for the circular ambition.

List of used literature:

- *Rashmi Anoop Patil et al.: Circularity Assessment: Macro to Nano*
- *Ellen Macarthur Foundation: Circulytics*
- *World Business Council for Sustainable Development: Strategic Outline*
- *World Business Council for Sustainable Development: Circular transition Indicators V4.0,*
- *Ramos, Tomas B.: How can organisations measure their level of circularity? A review of available tools; in: Journal of cleaner production 354*
- *Vitor Miranda de Souza et al: A mult-level resource circularity index based in the european union's circular economy monitoring framework, in: Waste and Biomass Valorization (2024)*
- *Draft European Sustainability Reporting Standards ESRS E5, EFRAG, November 2022*

Data we used are the sustainability reports of the mentioned 60 companies and of the 40 biggest german companies– we extracted all mentioned targets and example activities.

Technology Approach

Methodology

The research analyzed 2023 sustainability reports using these key criteria:

- Precision and transparency of Circular Economy targets
- Level of value retention in strategies
- Impact of objectives across company operations

Circularity Evaluation Framework
We distinguished five levels of circular targets:

1. Optimization
2. Re-design
3. Take-back systems
4. Circular business models
5. Circular ecosystem development

We categorized them according to our definition. First hand we focused on the idea of the value hill: what acitivities will save most of the value created and rated them accordingly. So at the end the companies with activities focusing on taking actively back products, parts, materials and using them again are in the top area and either follower or leader in terms of circular transition:

See this table definitions:

Rating of circular ambition categories (Level of retained value according value hill concept)	**Category**	**Definition**	**Example phrases**
1	Efficiency and Optimization (avoid waste)	Companies efforts are in replacing fossil based energy source with renewables, reducing the waste of energy and materials during manufacturing and operations.	"optimization in material use" "make the product lighter" "avoiding waste(production)" "We reduce material use" "We reduce water/energy use in manufacturing"
2	Design for circularity	Company starts using circular materials like recycled plastic, steel, aluminium; and begins to change the design of their products to create the foundation for a circular economy.	"modular parts and design" "easy to disassemble" "easy to recycle" "Our product is 100% recyclable" "we have used 50% of recycled aluminum" "Our product has now 10% longer life span, increased durability"
3	Establish processes to take back products or parts.	Company creates processes to get hands on their products again during or after use phase. R-Strategies apply: Take Back, Recycling, Remanufacturing, Repair.	"We collect or takeback XYZ" "We take the responsibility for our products/service" "Chemical recycling of our plastics" "owns or support the material recovery facilities..."

4	Earn money with circular strategies	Company uses R-Strategies as a fundemental part of their business to strengthen circularity like Remanufacturing, Product as a Service, Upgrades, with the goal to close, narrow or slow down loops. R-Strategies can be combined: Refurbish, Remanufacture, Upgrade, Repair, Reuse, collaborate, High commitment to show responsiblity for own products and materials with the goal to retain value as long as possible.	"We establish a second market for used goods" "We reuse our products as long es possible" "We change our business model to offer services instead of products"
5	Change your Industry towards a Circular Ecosystem	Establish shared networks of resources and energy to close loops and circulate materials/energy/parts; share digital infrastructure like platforms, ai-systems, robotics. This can happen in the own industry or cross-industry	"We work with suppliers and clients to establish a circular system" "We collaborate with competitors to establish standards"

Only the companies' sustainability reports from 2023 were analyzed based on the targets formulated there for the Circular Economy. The more precisely and transparently these targets were formulated (including concrete percentage values and quantities), the higher the rating. The targets were also rated according to the level of value retention. Resource efficiency alone receives a low rating, while taking back products and developing and rolling out completely new circular business models receive a high rating. The impact of an objective is also factored into the rating—pilot projects score low as a malus, while deployment across the company scores correspondingly high. To visualize the alignment with Paris Climate Goals, we used the MSCI Implied Temperature Rise.

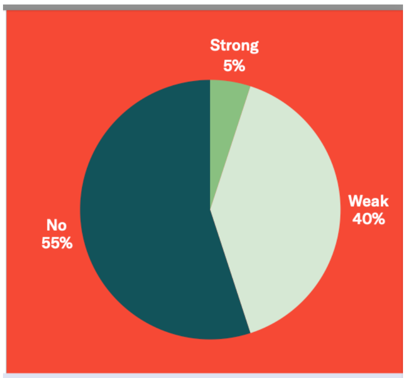
As we are looking at an initial snapshot, successes over time are not yet visible. Of course, it is more difficult for a company like Exxon Mobile to be circular than Alphabet.

However, both companies need to adjust their business practices and develop new products if they want to support the goal of establishing a Circular Economy.

Discussion

The largest U.S. companies display varied positions on the goal of a Circular Economy. Our analysis highlights the diverse strategies among U.S. companies, revealing a spectrum of leaders and laggards in the transition to a Circular Economy.

Just 35% of companies work on transforming their organization from the linear model to a more circular model. These companies stand out for their early, ambitious efforts. These front-runners, positioned in the two top quadrants of our matrix, are transitioning towards a Circular Economy by embracing all R-strategies, not just those enhancing production efficiency. Their actions significantly impact climate goals. Half of them (18%) aim for significant circular transformation. Another 17% are followers, showing not that much impact on their path to meet Paris Climate Goals. The majority (65%) follow the linear model. It includes two groups: those working ambitiously to reduce their CO_2 footprint and at least meet the 2°C target (37%) and those who have started these measures late and/or only did the minimum required by law (28%). There may be exceptions due to particularly high baseline levels of greenhouse gas emissions. However, the effect was long known to all companies, and there was plenty of time for preparation.



CIRCULAR ECONOMY TARGET

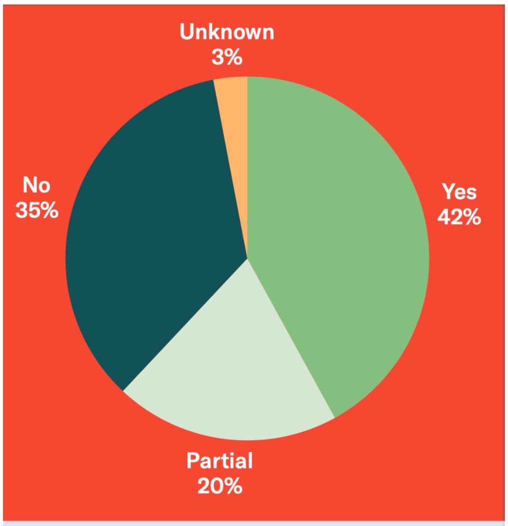
Strong: A specific year
Weak: A generic target like "we aim for a Circular Economy"
No: No target specified

40% of the selected Fortune 100 companies are committed to the Circular Economy, e.g., Home Depot: "We support circularity through recycling, repairing and reusing materials to reduce waste.", while only 5% set specific target dates. However, a majority of 55% have made no commitment yet.

While most companies (67%) commit somehow to being Net Zero by 2050, only 41% cover their targets completely over the whole supply chain (Scope 3). We distinguish five levels of circular targets (see also methodology on page 8). The lowest level is optimization. This involves saving resources such as energy, water and materials. The next levels are based on the R-strategies: re-design, take-back systems, circular business models and the development of circular ecosystems.

Our analysis now reveals how intensively companies set targets in these individual categories.

50% of the selected companies start to change the design of their products to create the foundation for a Circular Economy. This includes the use of circular materials like recycled plastic, steel & aluminum. The focus of these activities is on the re-design of packaging. Of the 30 companies, 24 set their goals to make their packaging reusable, recyclable or compostable. The majority make this claim for all of their packaging by 2030 at the latest.



HOW TARGETS COVER SCOPE 3

Complete: The company claims its target covers all Scope 3 emissions
Partial: The company claims its target covers part of its Scope 3 emissions, for example only upstream
No: The company does not include Scope 3 emissions in its target or fails to specify whether it does or not
Unknown: Not covered by the "NetZero Tracker"

Nevertheless, there is a long way to go-- the number of companies that also state this for their products is only 9 (30%).

Only 5% of companies are highly committed to taking responsibility for their own products and materials with the aim of preserving their value for as long as possible. Applying R strategies as a fundamental part of their business to strengthen the Circular Economy is one part of this. Which of these strategies are appropriate and how easy it is to apply them depends heavily on the products and services a company offers. It should be emphasized that 3 of the 5 companies in this category are manufacturers of high-value products that are expanding their remanufacturing business like John Deere, General Motors and Caterpillar. This is hardly surprising. Due to the fact that repairs are profitable for such products, these companies have started to develop this business early on.

Our study examines the Circular Economy ambitions of 60 of the Fortune 100 (2024) companies based on their publicly available sustainability reports. We focused on identifying companies with clearly defined Circular Economy objectives, as these hold more weight than vague mentions of activities. Ideally, these objectives are accompanied by documented progress reports. We excluded companies with no physical product like communication service providers.

By combining this analysis with a metric for each company's contribution to limiting global warming (MSCI Temperature Rise), we identified the following four distinct typologies: Circular Transformers, Circular Followers, Linear Traditionalists, Linear Optimizers.

Circular Transformer

These are companies that concentrate on preserving value throughout the entire lifecycle of a product. They implement various strategies like take-back programs for refurbishing and repairing products or spare parts. Additionally, they explore innovative models such as product sharing and collaborate with other companies to create closed-loop systems for materials and energy flows.

These leaders are already making a significant contribution to achieving the Paris Agreement's target of limiting global warming to a maximum 2°C rise. The MSCI Implied Temperature Rise metric measures their impact, and their documented progress towards self-set goals determines their position on the x-axis rating scale (ranging from 3.8°C, furthest from the target, to 1.3°C, closest to the target).

Circular Follower

The companies in this category share similar ambitions for a Circular Economy as the Circular Transformers. However, their actions haven't reached the scale needed to significantly limit global warming. This can be attributed to factors like legacy infrastructure – for example, General Electric continued use of fossil fuel power plants creates a lasting environmental impact. Companies in the higher tiers, however, demonstrate a stronger commitment to transforming their business models and capitalizing on the opportunities presented by a Circular Economy.

Linear Optimizer

This category stands out for achieving greenhouse gas (GHG) reductions that contribute significantly to the 2°C global warming target. What is striking here is the different approach to meet the sustainability goals.

Companies are focusing merely on publishing goals for efficiency gains or using circular materials they meet the Paris Climate Goal.

What's interesting some companies focus on circular design or circular material goals in the top tier. For those companies, targets seems to be a reliable measure to document progress in sustainability operations.

Nevertheless, utilizing reusables or making products recyclable (by INDEED's definition) is mainly a sustainability practice rather than actively closing loops in Circularity.

Linear Traditionalist

These companies prioritize established business models focused on cost control and legal compliance. While they're actively reducing greenhouse gas (GHG) emissions, their efforts haven't yet reached the level needed to significantly contribute to the 2°C goal.

Their approach often externalizes environmental impacts beyond the company's direct operations.

Additionally, their circular ambitions are limited to internal efficiency gains, like energy conservation, cost-driven waste recycling, and resource optimization (Mid Tier). They may also incorporate recycled materials when cost-effective (Top Tier).

Regulations, such as the upcoming 2030 mandate for recyclable packaging, will be implemented gradually. The companies in the bottom tier lack any stated Circular Economy goals.

Strategies to reach Paris Climate Goals

Based on the findings we see currently different approaches to reach Paris Climate Goals: depending on the industry companies first seek to reduce their scope 1 and 2 emissions. Level 1 always is reducing energy supply or switch to renewables. Second activity in general is reducing waste in production, optimising processes where possible. From that on, companies go deeper, try to focus on replacing virgin materials with renewables – which turns out to be more complicated than imagined due to changing qualities between batches, lower quality of renewables, not sufficient amount of material available and much more.

A consequence is to look into redesign products – and that is where real circular economy approaches start: Design for Repair, Disassembly; establishing circular business models and create circular ecosystems.

Companies that are offering services focus more on optimisation because it is simply enough to meet climate goals; companies that offer end products have to work on new business models and redesign their products and business models; companies with preliminary products and consumables have more difficulties f.e. plastics manufacturer or cosmetics industry. The latter often have first to focus on packaging and then redesign their receipies or work on breakthrough innovations.

Key Company Profiles

The following presents selected examples of companies representing the four typologies that emerge from this analysis. These profiles provide a snapshot of four companies'

Circular Economy efforts, highlighting both their achievements and areas for improvement.

Circular Transformer – AT&T Key Metrics:

- MSCI Implied Temperature Rise: 1.7°C
- Sustainability Goal: Carbon neutrality by 2035
- Circularity Goals:
- Target Year: no
- Objective: Support transition to Circular Economy

Interim Targets:

- Waste reduction: By 2030, reduce waste that ends up in landfills in the USA by 30% (base year 2019)
- Procurement: Sustainability metrics to be integrated into 80% of procurement decisions by 2025
- Scope 3: 50% of suppliers to set their own science-based Scope 1 and Scope 2 GHG emission targets by 2024
- Water Efficiency: AT&T is committed to reducing water consumption Current Achievements:

- Zero waste: In 2023, 0% of materials from take-back programs were disposed of in landfills
- Device take-back: 12.9 million electronic devices were taken back and recycled in 2023, in line with efforts to achieve zero-waste production (88% reused or sold, 12% recycled)

Key R-Strategies:

- Take-Back/Reuse: Customers can return their old devices through trade-in programs and in-home appointments where used devices are collected and reused
- Refurbish: Returned devices are refurbished to give them a “second life”, especially mobile devices
- Recycle: Devices and parts are recycled if they cannot be reused

Circular Follower - Hewlett Packard Key Metrics:

- MSCI Implied Temperature Rise: 2,1°C
- Sustainability Goal: Net Zero by 2040
- Circularity Goals: Target year: 2030
- Objective: Achieve 75% circularity by weight for products and packaging.
- Promoting sustainable standards in the supply chain and supporting progress towards climate targets and the Circular Economy

Interim Targets for 2025:

- Zero waste in HP operations
- Reaching 1.2 million tons of recycled hardware and consumables since 2016

- Eliminate 75% of single-use plastic packaging compared to 2018
- Use 30% post-consumer recycled plastic in HP's personal systems and printer products
- Reduce potable water use in global operations by 35% compared to 2015.
- 100% renewable electricity by 2025
- 65% reduction in Scope 1 and 2

Selected Achievements (2023):

- Circular Economy: 40% circularity by weight for products and packaging (use 18% recycled plastic in HP products; 62% less single-use plastic packaging (base 2018); repair of 75% of failed motherboards (557,000); recycled 992,000 tons of hardware and supplies since 2016
- Scope 1 and 2: 62% reduction since 2015
- Scope 3: 27% reduction since 2019
- 59% of global operations powered by renewable electricity
- Onboard 48 suppliers to apply Circular Economy principles, e.g. by using programs such as HP Planet Partners and HP Device Recovery Service

Key R-Strategies Applied:

- Reduce: HP aims to dramatically reduce the use of single-use plastics and water
- Reuse: Extending product life and reusing components through repairs and
- refurbishments Recycle: Aims to return large quantities of end-of-life products to the cycle
- Refurbish/Repair: reintroduce products and components to the market

Linear Optimizer – Alphabet Key Metrics:

- MSCI Implied Temperature Rise: 1,4°C
- Sustainability Goal: Net Zero by 2030

Circularity Goals:

- Target Year: no
- Objective: Create a 'Circular Google' by maximizing the reuse of finite resources across all operations, products and supply chains
- Interim Targets:
- Waste management: By 2025 all food waste is to be diverted from landfill; "Zero
- Waste to Landfill" for all global data centers (no year)
- Products: Use recycled or renewable material in at least 50% of plastic used in consumer hardware Packaging: 100% plastic-free product packaging by 2025 Current Achievements (in 2023):

- Waste Management: 82% of food waste has already been diverted from landfill
- Zero Waste: 29% of owned data centers have achieved Zero Waste to landfill
- Products: 34% of the plastic used in Alphabet products was recycled material

- Packaging: 99% plastic-free packaging of new Google products launched in 2023

Key R-Strategies Applied:

• Reduce: Reduction of waste and non-renewable resources by avoiding food waste and reducing plastic in packaging

• Reuse: Promotion of the longevity of certain products by providing longer software support + updates and patches

• Recycle: Use of recycled materials in hardware products
• Refurbish/Repair: Guidance and support for repair and reuse of devices

Linear Traditionalist – Kroger Key Metrics:

- MSCI Implied Temperature Rise: 3.6°C
- Sustainability Goal: 30% emission reduction by 2030 (baseline 2018)

Circularity Goals:

- Target Year: n/a
- Objective: no Interim Targets:

- Achieve operational waste detour of at least 90% from landfill by 2025
- Reduce total food waste in supermarkets by 50% by 2025 Ensure that over 95% of retail stores have active food waste recycling programs (2025)
- Achieve 100% recyclable, compostable, or reusable packaging for Kroger private label products. by 2030
- Increase the amount of recycled material in packaging so that the private label portfolio contains at least 10% post-consumer recycled (PCR) material in packaging (2030)

Current Achievements:

- Scope 1 and 2: 15.2% (2022)

- Operational Waste reduced: 82%
- Food waste reduced: 26.2% (2022)
- Share of retail stores with active food waste recycling: 45.9%
- Recycled Packaging for private label products: 37%
- Amount of recycled material

Key R-Strategies Applied:

- Reduce: Kroger is aiming to significantly reduce food waste in its supermarkets by 50% by 2025. It is also aiming to reduce the use of new plastic in packaging by increasing the use of recycled material
- Reuse: Kroger is working on making packaging for own-brand products reusable

- Recycle: Kroger takes no action to recycle by themself but plans to introduce 100% recyclable packaging for its own-brand products

Conclusions and Recommendations

This report has provided you with a snapshot of U.S. companies' ambitions and efforts toward the Circular Economy displayed in their corporate sustainability goals and Net Zero targets. Now it's time for action. Sustainability is a business imperative, and Circularity is one important lever that propels us forward. The transition hinges on a powerful synergy: effective regulations, evolving consumer preferences, and groundbreaking technology. We, as businesses, organizations, and individuals, have a responsibility to make this transformative outlook a reality. Systematic approach to Circular Transformation Businesses must adopt a systematic approach, leveraging circular strategies and fostering a culture of innovation. Imagine a "macro" view that considers complex value chains and material science, coupled with a "micro" focus on product design through multi-stakeholder collaboration. Additionally, it is essential to set up learning programs that embed circular thinking in your organization and empower your teams to champion the change. Here's a three-pillar approach to implementing circular strategies and delivering circular innovation:

1. Mapping the Circular Journey Vision, Strategy & Roadmap: Outline the course. Define a clear vision, craft a comprehensive strategy, and develop a detailed roadmap to capture new value-creation possibilities across industries. This includes identifying high-impact opportunities for circularity, exploring innovative business models that capture and retain value within product lifecycles, leveraging digital tools for material flow analysis and product traceability, and fostering cross-industry partnerships and consortium programs.

2. Designing the Circularity Design, Deliver & Close the Loop: Start with design principles that prioritize functionality, resource efficiency, and manufacturability. Develop clever solutions for product-as-a-service models, remanufacturing, and product life extension. Explore reusable, returnable, and recyclable packaging solutions and leverage digital technologies for reverse logistics and user experience optimization. Finally, envision future-forward scenarios and thought-provoking concepts to inspire circular innovation.

3. Championing Transformation This pillar focuses on embracing organizational change and guiding your organization through a successful circular transformation. Develop compelling business value propositions that demonstrate both the financial and environmental benefits of circularity for your organization. Measuring progress is key: conduct maturity assessments to understand your current state of circularity, set ambitious but achievable targets, and establish key performance indicators (KPIs) to track progress. Equally essential is facilitating multi-stakeholder engagement and industry partnerships to ensure alignment across your value chain and build a

collaborative ecosystem for circular innovation. If needed, work with third-party expertise that provides direction and support in implementing effective change management strategies to empower your employees throughout the journey.

It builds resilience, future-proofs operations, and boosts brand reputation. Businesses that champion circularity not only contribute to a healthier planet but also unlock new revenue streams, build brand loyalty, and future-proof their operations. In sum, circularity unlocks a competitive edge while collectively realizing the vision of a thriving circular future. As the Ellen MacArthur Foundation defines it, the Circular Economy is, by design, "a systemic approach to economic development that benefits businesses, society, and the environment." By joining forces, we can elevate individual efforts to an industry-wide transformation and create thriving ecosystems where innovation scales.

Future Development:

Our future work focuses on improving the methodology to make it easier to understand the ratings. We worked out a set of questions for each category f.e. the following excerpt:

C1	*C1Q1*	*Has the company set goals to reduce the consumption of virgin non renewable raw materials, or 100% achieved?*	*Material Use*
C1	*C1Q2*	*Has the company set goals to integrate circular materials (including virgin renewable raw materials), or 100% achieved?*	*Material Use*
C1	*C1Q3*	*Has the company set goals to reverse/prevent depletion of renewable materials, or 100% achieved?*	*Material Use*
C2	*C2Q1*	*Has the company set goals to redesign their products to enable circular economy principles (narrow, slow, close, regenerate)? [ESRS E5]*	*Design for Circularity*
C2	*C2Q2*	*Does the report state a goal to accquire any cradle-to-cradle certification goals or R&D investments in materials that enhance recyclability or extend product lifecycles?*	*Design for Circularity*
C2	*C2Q3*	*Does the report mention processes for incorporating feedback from product returns or end-of-life data into new product designs?*	*Design for Circularity*

Here we can the analyze the companies ambitions in a more structured way – and more strongly aligned to the existing ESRS Framework. We also want to give companies the opportunity to answer those questions – because not every goal is published in public reportings.

That allows us also to provide the companies with a questionnaire to get access to the the internal circularity goals and understand the difference between internal and external goals. From selected interviews we understand, that there are many legal topics, that prevent to publish certain sustainability figures after governments start fighting greenwashing more efficiently.

We also want to compare different regions and industries, to understand if there are different strategies.

Another next step of research is to follow on WSCBs Work on measuring circular maturity – which is a huge challenge for the companies.

About the Authors

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