

HP and the Circular Economy

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Introduction

The circular economy is driving a new approach to business around the world and will transform the way our economy produces and consumes goods and services. Leading companies are embracing this idea to create value for their business, customers and society. This case study of HP's approach to the circular economy provides insights into the drivers and product innovations of circular economy businesses.

What is HP's current approach to the circular economy?

HP is reinventing the way its products are designed, manufactured, used and recovered as it shifts its business model and operations towards a materials- and energy-efficient circular economy.

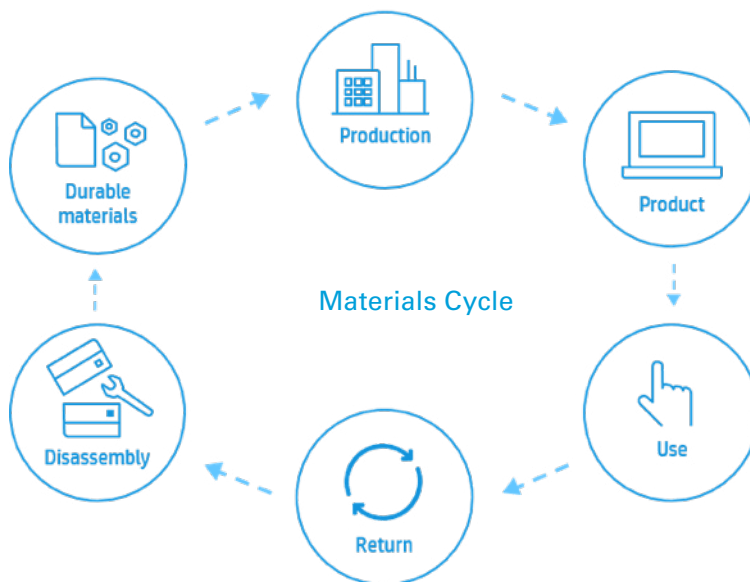
At HP, a key concept in the circular economy is a materials cycle—where plastics, metals and other durable materials are continuously being used and reused for high-grade applications, without being “down-cycled” into lower-grade uses that eventually become waste. To achieve a healthy materials cycle (see diagram), and reduce its product-related environmental impact, HP works to find alternatives to substances of concern, offers robust product recycling systems, designs for upgradeability and repairability and uses recycled content in new products. Together, these approaches drive its sustainability-driven materials management strategy. Equally, HP sees a business opportunity in designing products and services that meet and enable circular economy applications for its customers. It is committed to stimulating the development of recovered materials markets by using recycled content in new HP products.

The company's overall long-term and enduring ambition is to take responsibility for its products throughout the entire lifecycle—to understand and own the impacts of its products along the value chain. The vision is to keep its products and materials in circulation for as long as possible. The company wants to lead the industry in driving circular design and practice.

How does HP define the circular economy?

HP uses the Ellen MacArthur Foundation (EMF) definition:

A circular economy is one that is restorative and regenerative by design, and which aims to keep products, components and materials at their highest utility and value at all times, distinguishing between technical and biological cycles. [Source.](#)



How did HP get involved in the circular economy?

HP's circular efforts go back over 20 years to 1992.

- That year, the company started its Design for Environment program to ensure that energy efficiency, design for recyclability and materials innovation were factored in at the product design stage.
- In 1994, the company shipped its first multi-function printer/fax/copier, which, compared to the alternative of using three separate machines, used less power and represented a 30 percent reduction in materials used due to this consolidation of three products into one.
- HP's Planet Partners take-back and recycling program for ink cartridges was launched in 1995.
- HP started closing the recycling loop by 2000 when it began creating HP toner cartridges with plastic recycled from this program.

- Further advancements in closed loop plastics recycling continued in 2005 when the company used recovered polyethylene terephthalate (PET) from its ink cartridges as a material source for new ink cartridges. Through this program, returned ink cartridges are disassembled and separated into metals, plastics and other materials. The plastics are then processed and mixed with plastics from other sources, such as used bottles and plastic hangers, to create plastic for new cartridges (see text box for more detail).
- By 2016, HP had manufactured over 3 billion HP ink and toner cartridges using more than 177 million pounds of recycled content material—and as a result, kept 682 million cartridges, 50 million apparel hangers, and 3.3 billion postconsumer plastic bottles out of landfills, upcycling these materials for continued use. Today, more than 80 percent of the company’s ink cartridges contain recycled content (ranging from 45–70 percent), and 100 percent of HP toner cartridges contain recycled content (ranging from 10–33 percent). HP has plans to keep increasing the amount of recycled content in its cartridges.

These early product design, recycling and closed loop efforts positioned the company to embrace the circular economy philosophy in 2013, when it first heard about the concept from the Ellen MacArthur Foundation. As it explored the circular economy framework further, HP realized the idea was a perfect fit for the organization.

HP's story of how it closed the loop on its cartridges

HP's initiative to use recovered PET, a technical grade plastic, from ink cartridges as a source of materials for its new ink cartridges took seven years to fully implement. Using the HP Planet Partners reuse and recycling program as a collection source, the company created a sorting and separation process, some of which was automated to lower costs and increase material recovery, and developed pure material streams as inputs into new cartridges. It took time to qualify the material, ensure it didn't negatively affect the customer experience and roll it out across seven different production sites around the world.

There was a significant experimentation period. Growth, combined with the fact that not all of its cartridges are returned for recycling, meant that the company had to source material from other sources. Working with a Canadian plastics recycling company, HP developed an award winning process to upcycle PET bottles and polypropylene-based clothing hangers into their new cartridges, creating a fully closed loop product. Its cartridges are returned, separated, re-formulated and re-pelletized and put directly into the company's manufacturing process.

Along the way it learned about reverse logistics, the need to control its own product streams, and how to capture the most value from the material (leveraging a lifecycle assessment process which also showed a footprint of 33 percent less than using virgin plastic). Importantly, these learnings helped to speed up subsequent development projects (and the realization of savings) with a third project being implemented in less than 12 months as a fully closed loop process with no additives.

The company learned as it went, becoming more efficient at reverse logistics and developing pure material streams with each innovation. Today the company has an economical input compared to virgin materials, over 80 percent of ink cartridges contain closed loop plastics, while scaling this closed loop process has become the building block for other projects.

Why is HP embracing the circular economy?

Holistic: HP has a long track record of reducing its environmental impacts. The circular economy framework appeals to HP because it provides a comprehensive, unified approach to environmental footprint reduction. It brings many of HP's environmental priorities together under one umbrella, including resource and energy efficiency (its design for the environment program) and the use of more benign materials, providing guidance on what to prioritize.

Trends: The circular economy concept helps companies address macro trends of population growth, the growing middle class, increasing urbanization, the rise of the sharing economy and related resource impacts. It provides a signpost of what will be important to customers and businesses in the future. It positions HP to prepare for these trends. A great example is HP's commercial 3D printing technology which is set to revolutionize supply chains (see text box).

Innovation: Applying a circular economy lens to its business opens up opportunities for disruptive innovation at HP. By developing and applying advanced information technologies, HP can help scale the growth of the circular economy and create a competitive advantage.

Regulation: Governments around the world are introducing policies and regulations to support and promote the circular economy. Through its participation in the circular economy movement, HP helps influence and anticipate future regulations and policies.

Customers: Circular economy innovation provides an opportunity for the company to meet and exceed customers' environmental and innovation expectations, such as waste reduction. Application of service-based models will drive a move from transactions to strong ongoing client relationships. HP has developed a supply chain resilient to the price spikes expected in commodities in the future, as demand increases.

While closing loops and reusing material were not new ideas to HP, the strong business drivers, changing customer imperatives and information and industrial technology revolution created an economic argument that was. The circular economy concept provided a new paradigm for a new economy, and a pathway for a company seeking to decouple its environmental impacts from its growth. In addition, a number of important HP customers were engaged in circular economy initiatives, particularly in Europe.

3D printing technology is an enabler of the circular economy

HP's 3D printing solution Jet Fusion, launched in 2016, is an important enabler of the circular economy. This disruptive technology (a manufacturing process that builds layers to create a three-dimensional solid object from a digital model) facilitates efficient materials use by streamlining the prototyping process, improving the economics of short-run manufacturing, extending product lifecycles and avoiding waste associated with mass production. With 3D printing, customers have a virtual unlimited inventory of spare parts, meeting just-in time needs and balancing supply and demand. HP's commercial 3D printers will help customers eliminate waste by enabling fast, localized, customized and accurate production of parts and finished goods. Because all products will be made to order, demand variations and obsolescence will decline rapidly, warehousing will be minimized and repairs will become easier, faster and less expensive.

What circular business models are HP pursuing?

Using the [circular business model framework](#) developed by Accenture, HP has the following circular business models in place (see Accenture report for a full description of the business models).

Resource recovery: Resource Recovery and Recycling recovers useful resources out of disposed products or by-products. HP recycles plastic content in its ink and toner cartridges and is committed to incorporating more recycled materials into its products to support the material recovery market and reduce the need for future resource extraction. To be effective in doing this, the company focuses on removing substances of concern from its product materials to facilitate their reuse into new products. HP also participates in end-of-life component harvesting by reusing PC and printer hardware components in refurbished products.

Product life extension: Product Life Extension relies on remanufacturing, repairing or upgrading and reselling used products and components to give them a longer life with existing or new customers. This approach keeps products in use longer. A key HP material conservation priority is modular product design to support repairability and aid eventual refurbishment and upgrading to extend the life of its product lines. It is increasingly focused on designing products to be easily serviced and is ramping up the incorporation of smart technology to enable prompt servicing and repair. HP finds that modular design provides customers upgradeable capability as their needs evolve, eliminating the need for costly equipment replacement and the related resource impacts. For example, HP offers a reconditioning program for its digital presses in which units sourced from customer trade-in undergo refurbishing at company factories and are resold. HP's adherence to US Military Standards durability specifications such as drop and water resistance, along with repairability requirements are being built into new products such as its Elite X3, a "phablet" combining PC power, tablet portability and smartphone connectivity. HP's increasing focus on repairability is earning its products top marks by an online repair start-up, iFixit, which rates products for their repairability (see text box). The company also makes its repair manuals readily available so customers can extend the life of their devices for a long time.

HP leads the way in product repairability

“Today, we gave our first ever 10 out of 10 repairability score—to HP’s new Z1 all-in-one workstation! It is the most repairable PC we’ve ever had the pleasure to take apart. Opening the machine is as easy as opening a briefcase, and all the major components—RAM, hard drive, optical drive, etc.—snap in and out. There’s even a diagram inside the device that shows the location of the most easily replaceable components. You could probably replace the hard drive in five minutes and have time left over to sip a coffee.

“A few of the non-major components require a little more effort to pull out, but never so much as to be dangerous or painful. Removing the glass and LCD, for example, requires taking out ‘a few’ T15 Torx screws (18, to be exact). However, there are no crazy glues or breakable tabs hindering your repair process.

“Our final determinant for a perfect repairability score was the existence of actual repair manuals for the machine. To our delight, HP has provided these materials directly on their site. They’re not as good as iFixit’s manuals, but they’re definitely solid enough to repair/upgrade the machine.” April 2012 [Source](#).

Product as a service: Product as a Service replaces ownership-based models with usage-based services. These encourage companies to maintain products for longer and offer new services, such as predictive maintenance. HP is moving into the product as a service business model by focusing on leasing, renting and other service contracts for ink, print and PC services. For example, HP’s ink subscription service, HP Instant Ink, has more than 1 million subscribers in six countries. The service ensures customers never run out of ink when they need it, and that they can recycle used cartridges more efficiently (returned cartridges are fed into HP’s closed loop recycling program). Through the service, an internet-connected printer notifies HP when it is running low on ink, and a replacement cartridge is automatically delivered. Compared with conventional business models, printers using this service generate up to 67 percent less materials consumption per printed page. With its print and PC subscription services, commercial customers can access the latest and most energy-efficient IT products without the up-front costs of purchase. Every two to three years, HP commercial customers can upgrade to the newest hardware and software, supported by a service relationship that keeps products running smoothly. For example, its Managed Print Services offers a customizable set of solutions—including devices, network print management software, supplies, support and end-of-life hardware options—that reduce customers’ printing-related energy usage up to 40 percent, decrease costs up to 30 percent, and lower paper waste 25 percent or more.

In addition to these three circular business models, HP pursues dematerialization strategies to reduce the material intensity of its products. It began this journey over 20 years ago when it shipped its first multi-function device. By 2015 its materials use intensity for personal systems decreased (improved) by 18 percent, compared to 2014, driven by the ongoing shift to smaller desktops and laptops. The company tracks and reports its material use intensity for metal, plastic, wires and cables, circuit boards, LCDs (liquid crystal displays) and batteries in its online sustainability reports.

Circular packaging

Packaging design is complex, requiring consideration of product protection, environmental impact, customer expectations and cost. The six principles HP applies in its sustainable packaging activities reflect its circular economy ambitions:

- Increase the use of recycled content
- Replace hard-to-recycle materials
- Reduce packaging material use in each new product
- Design packaging for reuse, where feasible
- Ensure that substances of concern are not used in HP packaging
- Ensure the use of sustainable materials

In 2016, HP advanced on these principles by committing to achieve zero deforestation by 2020. All HP brand paper and paper-based product packaging (i.e., the box that comes with the product and all paper, including packaging and materials, inside the box) will be derived from certified and recycled sources by 2020.

What has HP learned?

These are some of the challenges HP has faced scaling its circular solutions.

Legislative barriers: Government policy and regulation have not kept pace with circular economy requirements. For example, in the EU all electronics are considered waste and difficult to move across borders. This makes it challenging to enable product take-back and consolidate repair.

Material quality: It is essential to ensure the technical performance of the recycled material to maintain customer confidence. Controlling reverse logistic routes and developing pure material streams are important pre-conditions.

Customer take-up: A consumer mind-shift is needed to reward circular economy innovation. The millennial generation is more receptive to product as a service while older generations are less likely to share, lease or borrow. Equally, enterprise buyers usually favor lowest cost purchases over products with a lower total cost of ownership which considers the direct and indirect lifetime costs of product ownership.

Retailer impacts: Retail channels are incentivized to sell products. Shifting to product as a service necessitates different incentive structures for retailers and sales agents.

Disruptive innovation: Circular models disrupt the status quo. New business models can destroy or cannibalize a company's existing value proposition. The innovations may not be as or more profitable for a time—it can take more effort to sell new products than those on the shelf. New capabilities and investments are often needed and can slow down the dissemination of an idea.

Addressing the challenges

HP realizes that to advance the circular economy and gain the commercial benefits that await demands business leadership, collaboration and effective public policy. HP belongs to the [Ellen MacArthur Foundation Circular Economy 100](#), a global platform of leading companies and innovators working to accelerate the transition to a circular economy. Its input, so far, has included participation in a working group on reverse logistics and providing case study material for [Intelligent Assets](#)—an EMF report on the connection between the Internet of Things and the circular economy. The company also contributes to public policy discussions related to the transition to the circular economy. Areas of public policy focus include the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal and the legitimate movement of used equipment. Leadership, industry collaboration and public policy engagement are some of the [Qualities of a Transformational Company](#), exemplified by HP. To accelerate and scale the circular economy, HP invests in both internal and external initiatives, thereby creating customer, societal and business benefits.

About this report

Who is HP?

HP Inc. is a US-based multi-national information technology company with a portfolio of printers, PCs, mobile devices and services. Its mission is to make life better for everyone, everywhere. To learn more, view the [HP Sustainability Report](#).

Acknowledgements

Coro Strandberg, President of Strandberg Consulting, created this case study. She compiled it from company interviews, internet research and corporate communication materials. Coro is a recognized Canadian expert in corporate sustainability and corporate social responsibility. She specializes in sustainability leadership, including the [Qualities of a Transformational Company](#) and Circular Business Models. For the National Zero Waste Council, Coro has authored a set of [circular economy case studies](#) and a [circular economy business toolkit](#). More information is available on her [website](#).