



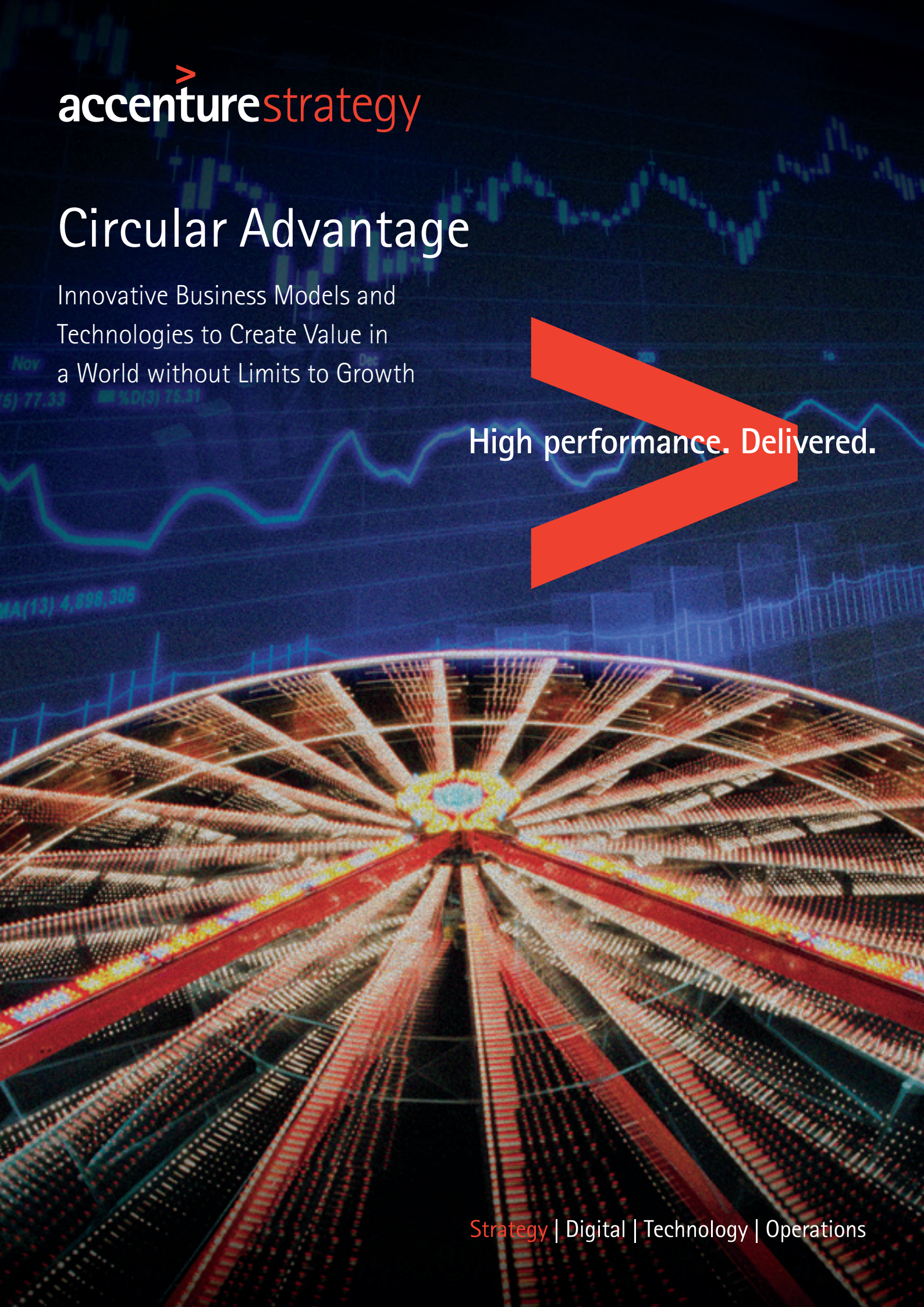
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Circular Advantage

Innovative Business Models and
Technologies to Create Value in
a World without Limits to Growth



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Circular Advantage

Innovative Business Models and Technologies to Create Value without Limits to Growth

Executive Summary at a Glance

- Companies face a rapidly increasing challenge, and opportunity, to grow their businesses and create value amidst volatile and scarce supply of natural resources and environmental concerns, driving up prices and uncertainty.
- Circular Economy – an alternative model decoupling growth from scarce resource use – provides the key to managing this challenge at both the macro and micro level, allowing economic development within natural resource limits and allowing companies to innovate to enable customers and users to do 'more with less'.
- Accenture's client experience and research show leading global companies are following the lead of innovative smaller enterprises, applying the circular economy as a framework for growth and innovation towards 'Circular Advantage' in what our research shows is already a trillion dollar plus prize.
- Five circular business models (Circular Supplies, Resource Recovery, Product Life Extension, Sharing Platforms and Product as a Service) and ten technologies—in particular 'digital' in the form of social media, cloud computing, analytics and mobility—are enabling speed and scale in ways not seen before.
- These business models and technologies are making possible a fundamentally 'customer-centric' approach to Circular Advantage beyond simply efficiency gains which require a new mindset amongst executives and a new set of capabilities at the intersection of strategy, technology and operations.
- To understand and capture the full business opportunity of Circular Economy, top executives need to ask themselves tough questions on the opportunity, value, capabilities, technology and timing of their investments on the journey to Circular Advantage.



Introduction

The growth model favored by economies and indeed most companies for the past 250 years—based on the availability of plentiful and inexpensive natural resources—is living on borrowed time and, so are companies that rely on it. That's the consensus of research efforts and practical experience of the past two decades, including our own at Accenture.¹

This body of research and experience tells us that when resources are abundant and inexpensive (and the impact on the environment is not a prevailing concern), the current "linear" approach to satisfying demand can be very successful. Companies are able, with ever-increasing efficiency, to extract raw materials, use those materials as inputs to the manufacturing of desired products, and sell and ship those products to as many customers as possible (who use and discard them after the products have served their purpose). Put in shorthand, an economy built on the principles of 'take, make, waste'.

However, we are rapidly approaching a point at which the linear model is no longer viable: when, due to rising global affluence, the availability of many non-renewables (including metals, minerals, and fossil fuel) cannot keep up with demand, the regenerative capacity of renewables (such as land, forests, water) becomes strained to its limits, and the planetary boundaries become threatened as never before. As shown by the IPCC², US National Climate Assessment³, and many others, negative effects of the current growth model are already being reported on all continents. Accenture research⁴ shows that unless current

trends are reversed, resource supply disruptions coupled with rising and increasingly volatile prices will in the next two decades translate into trillion-dollar losses for companies and countries whose growth remains tied to the use of scarce and virgin natural resources.

For businesses and their top executives, responsible for setting the direction of their firms, this leads to one inescapable conclusion: Continued dependence on scarce natural resources for growth exposes a company's tangible and intangible value to serious risks.

- Revenue reduction: Supply uncertainties and changing consumer preferences could prevent companies from generating revenues and maintaining market share. For instance, companies that depend heavily on scarce resources might have to shut down production at times and be unable to deliver demanded volumes.

- Cost increases: Companies whose growth is tightly tied to scarce resources will find themselves at a competitive disadvantage due to rising and volatile prices that reduce their ability to forecast and compete with less resource-intensive competitors.

- Intangible assets: A company's environmental footprint and resource dependence could erode brand value as consumers shun companies with unsustainable business practices. And, as planetary bottlenecks and resource scarcity become more critical, policymakers likely will favor companies that can prove they have positive societal impact and can operate without depleting the country's natural resources.

¹ Examples of Accenture research with a perspective on the circular economy include World Economic Forum, "More With Less: Scaling Sustainable Consumption and Resource Efficiency," January 2012 (<http://www.accenture.com/us-en/Pages/insight-more-with-less-scaling-sustainable-consumption-resource-efficiency.aspx>); World Business Council for Sustainable Development, "Vision 2050: The New Agenda for Business," February 2010 (http://www.wbcsd.org/web/projects/BZrole/Vision2050-FullReport_Final.pdf); and United Nations Global Compact and Accenture, "The UN Global Compact—Accenture CEO Study on Sustainability 2013," September 2013 (<http://www.accenture.com/SiteCollectionDocuments/PDF/Accenture-UN-Global-Compact-Acn-CEO-Study-Sustainability-2013.PDF>)

² Intergovernmental Panel on Climate Change, "Climate Change 2014: Impacts, Adaptation, and Vulnerability," October 2013 (<http://www.ipcc.ch/report/ar5/wg2/>)

³ National Climate Assessment, U.S. Global Change Research Program, "Climate Change Impacts in the United States," (<http://nca2014.globalchange.gov/>)

⁴ Modeling for this paper is done using data from the United Nations Population Division, World Bank, HSBC "World in 2050," OECD long-term outlook (Economic Outlook No 93 - June 2013 - Long-term baseline projections), Global Footprint Network, IPCC, The Conference Board, "The total economy database," and Krausmann, F., Gingrich, S., Eisenmenger, N., Erb, K.H., Haberl, H., Fischer-Kowalski, M. "Growth in global materials use, GDP and population during the 20th century." The model uses population and economic growth from 1961–2050 together with resource intensity variables for biomass, fossil energy, ores and industrial minerals, and construction minerals to forecast future demand per resource category. Improvements in resource intensity have been included to allow simulation of various technological development scenarios. Global resource availability has been modeled by connecting ecological footprint data to economic output and checking against resource reserve estimates. Ninety percent of construction mineral volumes are removed to adjust for non-scarce resources such as sand and gravel. A relatively weak stabilization trajectory is used for this paper, where movement to a one-planet economy starts in 2016 and is reached not before 2050.

What's the alternative?

The answer is the circular economy.

In a circular economy, growth is decoupled from the use of scarce resources through disruptive technology and business models based on longevity, renewability, reuse, repair, upgrade, refurbishment, capacity sharing, and dematerialization. Companies no longer focus mainly on driving more volume and squeezing out cost through greater efficiency in supply chains, factories and operations. Rather, they concentrate on rethinking products and services from the bottom up to “future proof” their operations to prepare for inevitable resource constraints – all the way through to the customer value proposition. This implies eliminating waste, creating step changes in resource productivity and at the same time enhancing the customer value proposition on dimensions such as price, quality and availability.

By design, circular economy models require companies to become highly involved in the use and disposal of products, finding ways to move revenue generation from selling the physical stuff to providing access to it and/or optimizing its performance along the entire value chain. Take a conventional power drill as a telling case. A power drill is typically used for less than 20 minutes during its life cycle⁵ and while customers need a hole in the wall – the market supplies millions of tools collecting dust most of the time. If, instead, users had convenient access to a high-quality tool only when needed, they could save money and time while the product could be optimized for longevity, component reuse, recycling, GPS tracking for finding the nearest tool, user communities for advice, mobile payments to simplify pick-up and drop-off. This thinking can be applied to anything from DIY tools to trucks,

buildings, printers, etc. Once a business goes circular, every aspect of it must be configured with the use and return in mind in addition to production and selling. In this sense the circular economy brings about a massive re-alignment of customer and business incentives – no more intentionally designing products to break down, for obsolescence or disregarding externalities.

Many companies across the globe have already adopted circular principles to close the loop on energy and material through efforts such as renewable energy investments and recycling. What's making this space truly exciting? Pioneering innovators have realized the circular economy is not only about resource supply and use efficiency, but indeed even more about evolving their business models to transform the nature of resource demand from the customer's point of view, as in the case of the power tool. Research by Accenture has identified more than 100 truly disruptive companies applying circular economy thinking and new technology to transform in ways that seriously threaten incumbents. We call the competitive edge these companies gain the “circular advantage”. Net-net, the circular advantage comes through innovating for both resource efficiency and customer value—delivering at the heart of a company's strategy, technology and operations.

Take, for instance, Nike, which has worked for years on ways to balance the dual demands of resource productivity and value delivered to customers. This pursuit has fostered numerous innovations that have boosted the performance of products in the marketplace while reducing the products' environmental impact. One example is Nike's Flyknit™ technology, which enables the company to create a shoe upper out of a few single threads. The result is a less-wasteful

(by 80 percent) production process that renders a better-fitting and lighter shoe that can help boost an athlete's performance. Flyknit and similar efforts reflect the central role circular thinking plays in Nike's business. “We build our business by decoupling our growth from resources that are becoming increasingly scarce,” wrote Hanna Jones, Nike's vice president of Sustainable Innovation, in a post on the Nike blog. “This isn't our sustainability strategy, it's integral to our business strategy.”⁶

Circular thinking also drives the very mission of Novozymes, a world leader in biotechnology. The company focuses on applying innovation in biorefining to help the world shift from an economy based on non-renewable (linear) oil to one that uses renewable (circular) plant- and waste-derived food, feed, fuel and materials instead. Novozymes sees such activity as the cornerstone of a bigger renewable economy that can “replace oil, strengthen security of food and energy supplies, create 'green' jobs, increase incomes and ensure green growth—all at the same time.” Among the most compelling by-products of this growth strategy is a 75 million-ton reduction in CO2 emissions by 2015 through its customers' application of Novozymes' products.⁷

Our research on Nike, Novozymes and others like them reveals three key things businesses need to understand to successfully play in the circular economy:

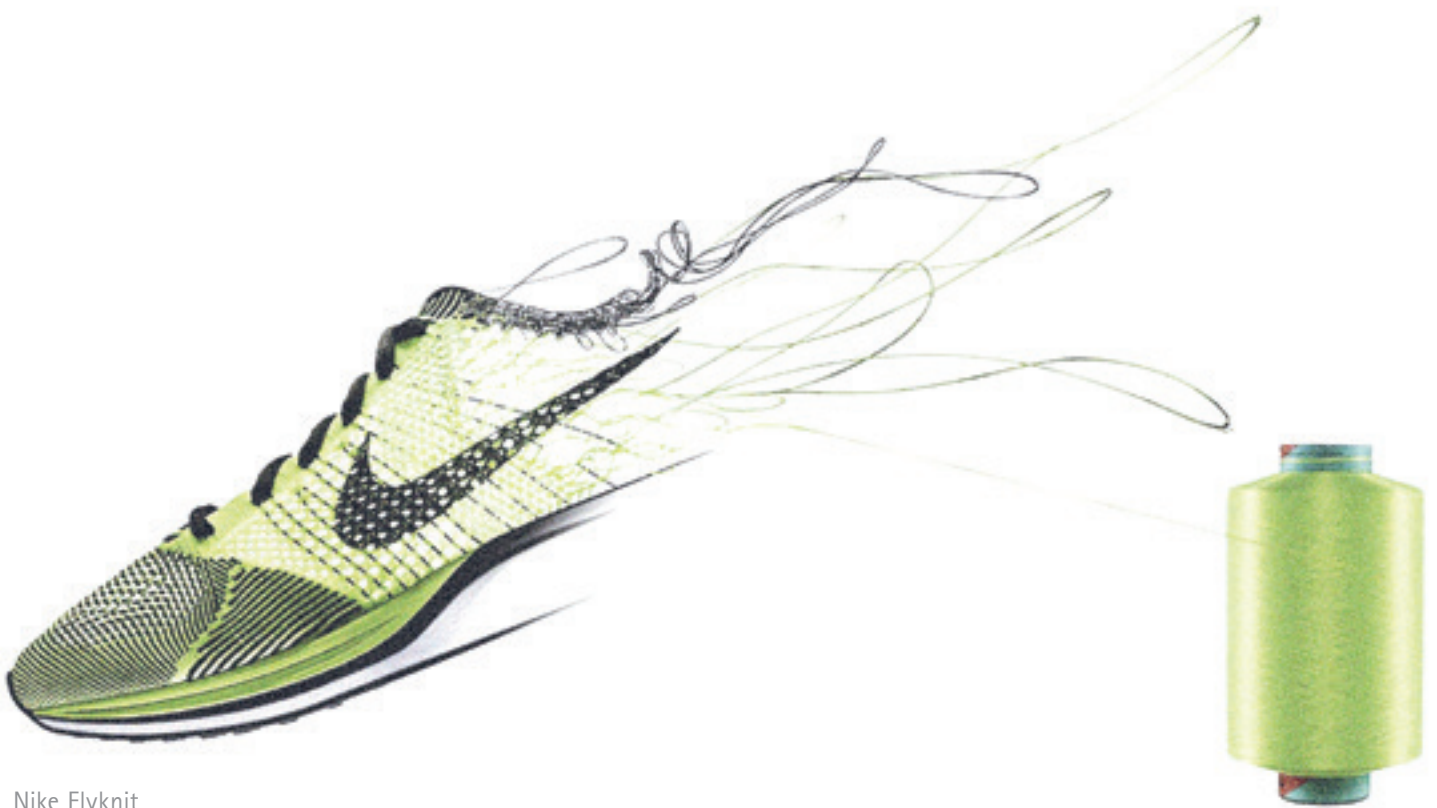
1. The emergence of five circular business models available to companies
2. The role of five new business capabilities required to deliver them
3. The disruptive power of ten digital and engineering technologies enabling change

When used together the three shape new value chains—less exposed to resource supply risks, more focused on customer value creation and with more attractive cost structures. These new value chains can result in massive productivity gains. How much? Up to four times the amount—enough to tackle the estimated 40 billion ton material shortage we'll reach by 2050. Not a bad advantage considering that in a typical modern manufacturing company materials make up around 40 percent of total costs, compared to less than 20 percent for labor.

⁵ Thomas L. Friedman, "Welcome to the Sharing Economy," The New York Times, July 20, 2013 (http://www.nytimes.com/2013/07/21/opinion/sunday/friedman-welcome-to-the-sharing-economy.html?pagewanted=all&_r=0)

⁶ World Economic Forum, "How can companies leave a lighter footprint?" January 24, 2014 (<http://forumblog.org/2014/01/can-companies-leave-lighter-footprint-world/>)

⁷ Novozymes, "Biobased economy: Replacing an oil-based with a green economy," 2014 (<http://www.novozymes.com/en/sustainability/benefits-for-the-world/biobased-economy/Pages/default.aspx>)



Nike Flyknit

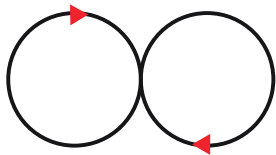
Calculating the Value of the Circular Economy

In the past few years, several notable studies⁸ have produced estimates of the overall value of the circular economy, often with diverging results. The reason for this is a lack of common definition, which means the resulting estimates depend on the boundaries applied to the circular economy—key assumptions underlying the analysis, and analytical approach. Most commonly, bottom-up calculations are made using representative products, material or industries and, as such, are not comparable to studies using other industries, material and products as starting points. In many cases, the focus is on material cost savings (i.e., a waste and recycling perspective)—an important aspect, but one that does not provide the full picture. Across the studies, however, we conclude that the circular economy has the potential to become a trillion-dollar opportunity globally in the near future.

In our latest research, Accenture has taken a top-down approach based on a holistic definition of the circular economy and an analysis of the different ways in which resource supply and demand patterns can be shifted by it. This approach enabled us to get the broadest view of value potential and where it sits. Our research found that for the global economy, the full set of circular economy approaches can add over five times the value of current best estimates by 2030 by reducing resource constraints to growth. A detailed set of data will be made available in a forthcoming book but we can now reveal that this value is divided into four broad areas (Figure 1).

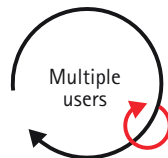
1. **Lasting resources** that can be continuously regenerated over time to not only last longer (efficiency) but last forever (effectiveness) (e.g., renewable energy and biochemicals): Approximately 40 percent of total value
2. **Liquid markets** where products and assets are optimally utilized by becoming easily accessible and convertible between users (e.g., sharing / trading idle product and asset capacity): 10 percent
3. **Long life cycles** where products are made to last (e.g., monetizing product longevity through service, upgrade and remanufacturing): 30 percent
4. **Linked value chains** where zero waste is generated from production to disposal (e.g., boosting recycling and resource efficiency) 20 percent

Figure 1: Areas of value creation in the circular economy



Lasting resources

Breaking the link between resource scarcity and economic activity by using only resources that can be continuously regenerated for productive use



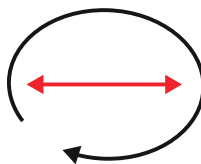
Liquid markets

Eliminating idle time of products in the markets in order to grow the number of users that gain benefit from the same volume of goods



Linked value chains

Minimizing resource value destruction in a value chain by reclaiming and linking up waste outputs as useful inputs into a next life production process



Longer life cycles

Keeping products in economic use for longer to satisfy a greater demand and provide more utility without needing additional natural resources

The Trouble with the Prevailing Growth Model

There are volumes of research that highlight the problem of increasing resource scarcity and mounting waste.⁹ Accenture's own analysis confirms the strong relationship between resource consumption and GDP (Figure 2). In fact, historically for every 1 percent increase in GDP, resource usage has risen on average 0.4 percent.¹⁰ This means population and economic growth are key drivers of resource demand. Clearly, economic development as we know it and resource scarcity are on a collision course.

Fortunately, commodity prices have been historically inversely related to growth. Costs declined automatically. But around 2000 this relationship reversed (Figure 3), making reliance on resources for growth increasingly unattractive.¹¹ As a growing population and expanding global middle class drive demand for resources, these trends will continue and ultimately threaten continuation of business as usual.

The world is already using approximately 1.5 planet's worth of resources every year. Based on the current pace, we'll consume three planets by 2050.¹² It's an unsustainable scenario, especially given the lack of disruptive innovations on the horizon that can scale quickly enough to change the trajectory.

⁹ Ellen MacArthur Foundation, "Towards the Circular Economy," Volumes 1 and 2, 2012-2013, (<http://www.ellenmacarthurfoundation.org/business/reports/ce2012> and <http://www.ellenmacarthurfoundation.org/business/reports/ce2013>); The Netherlands Organisation for Applied Scientific Research, "Opportunities for a Circular Economy in the Netherlands," 2013 (<http://www.government.nl/documents-and-publications/reports/2013/10/04/opportunities-for-a-circular-economy-in-the-netherlands.html>); Waste & Resources Action Programme (<http://www.wrap.org.uk/content/eu-vision-2020>); Lin Huocan and Liu Cheng, "Circular Economy Poised for Rapid Growth," China Economic Net, June 29, 2012 (http://en.ce.cn/Insight/201206/29/t20120629_23449603.shtml); World Economic Forum & Accenture, "More with Less: Scaling Sustainable Consumption and Resource Efficiency", 2012

⁹ Among those who have already explored the connection between growth and resource consumption include The Club of Rome (<http://www.clubofrome.org/>), Ernst U.von Weizsacker in Factor Four: Doubling Wealth, Halving Resource Use (<http://www.amazon.com/Factor-Four-Doubling-Halving-Resource/dp/1853834068>), Walter R. Stahel in The Performance Economy (<http://www.amazon.co.uk/Performance-Economy-Walter-R-Stahel/dp/0230584667>), The Ellen MacArthur Foundation (<http://www.ellenmacarthurfoundation.org/>), and the United Nations Environment Programme's International Resource Panel (<http://www.unep.org/resourcepanel/>).

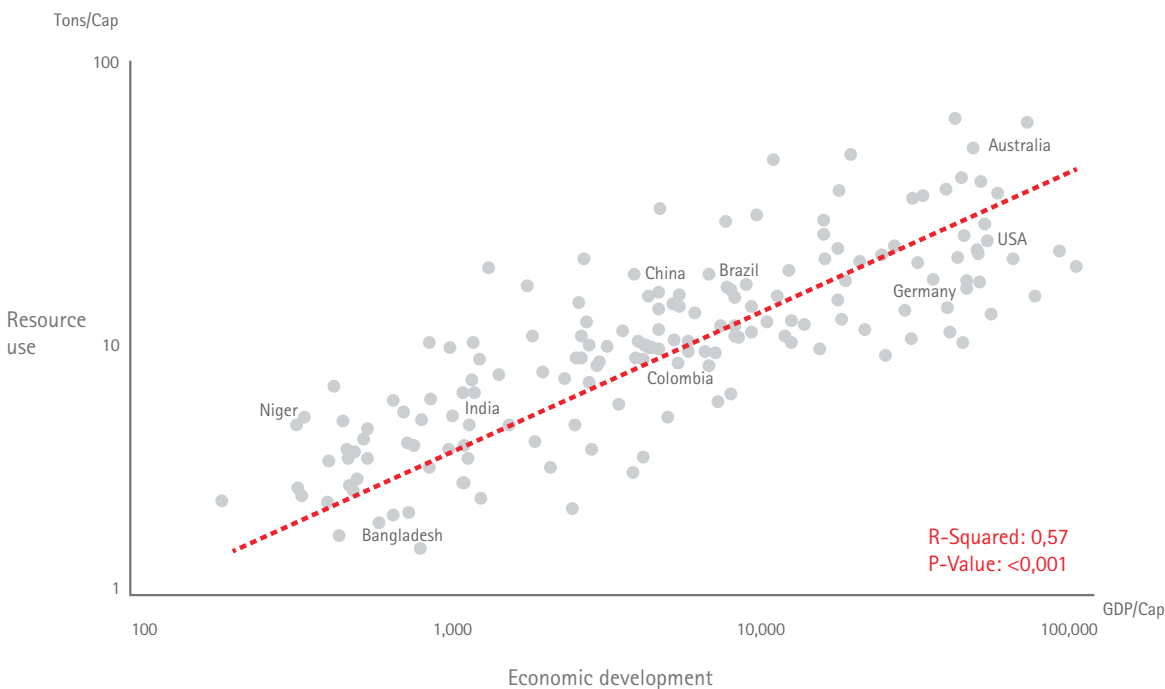
¹⁰ Accenture analysis based on data from SERI and Dittrich, M. (2014). Global Material Flow Database. 2014 version and World Bank GDP data, <http://data.worldbank.org/>

¹¹ Accenture analysis based on data from World Bank, Commodity Price Data (The Pink Sheet), April 2014 version

¹² Global Footprint Network (2012)

Figure 2: Around the world, the link between increased resource use and growth is evident

Log plot of Resource use and Economic development, 166 countries



Along with this excessive and unsound use of natural resources are myriad environmental problems: soil degradation, water acidification, air pollution, waste generation and carbon emissions, to name a few. These are leading to a transgression of the nine key planetary boundaries identified and quantified by a team of 28 internationally renowned scientists.¹³ We've passed three already—rate of biodiversity loss, climate change, and human interference with the nitrogen cycle¹⁴, threatening abrupt or irreversible environmental changes that can have far-reaching social and economic consequences.

If nothing is done to address the situation, total demand for limited resource stocks (like biomass, fossil energy, and many metals) is expected to reach 130 billion tons by 2050. That's up from 50 billion in 2014 and it will result in more than 400 percent overuse of Earth's total capacity—a feat that's physically impossible. Even with a relatively optimistic forecast for technological innovation and improvements in resource efficiency, demand for limited resources will be 80 billion tons with an overuse of around 40 billion tons by 2050 (Figure 4). The economic impact of resource scarcity on this scale would be devastating.

Needless to say the economic impact of resource scarcity on this scale would be devastating.

¹³ <http://www.stockholmresilience.org/21/research/research-programmes/planetary-boundaries/planetary-boundaries/about-the-research/the-nine-planetary-boundaries.html>

¹⁴ Ibid.



Figure 3: After the year 2000, a new trend in the growth and resource use dynamic can be seen

Commodity price & GDP index 1975-2013

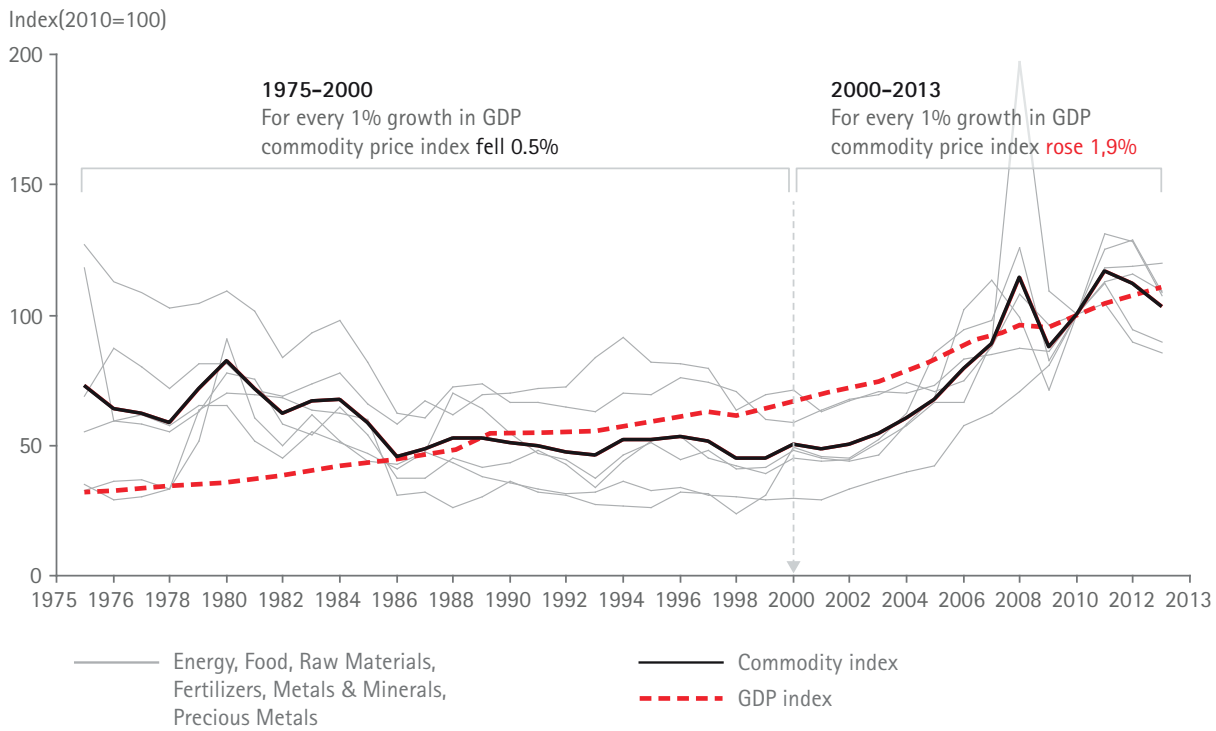
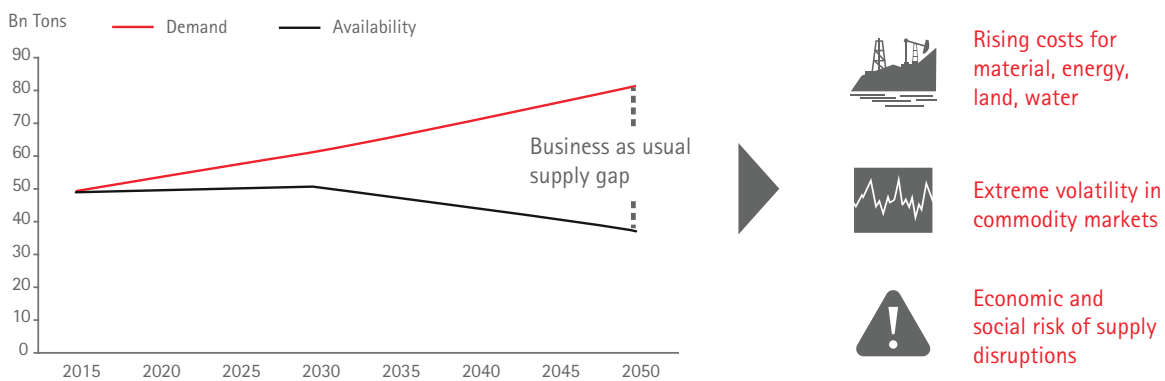


Figure 4: The widening gap between sustainable resource availability and demand

Resource supply / demand imbalance 2015-2050



Scenarios include limited resource stocks only and therefore differ from total material consumption. Most notably exclude construction mineral volumes (e.g. sand and gravel) where scarcity is not an issue

The Circular Economy: The End of Business as Usual

Business as usual simply cannot continue. Governments and companies around the world are looking for alternative approaches to drive future growth. The circular economy is one of the few viable and scalable growth models that can radically improve resource productivity to reverse these trends. And, in the process, drive greater innovation and job creation. Better yet, it promises to transform the dynamics of competitiveness and bestow real competitive advantage to early movers. In the case of the EU, for example, it has been estimated that every one percent increase in resource efficiency is worth as much as 23 billion euro for business and can create up to two hundred thousand jobs.¹⁵

At its core, the circular economy is about creating new value chains that decouple growth from the use of scarce and linear resource inputs—i.e., inputs that cannot be

returned and used in cyclical chains. This can be accomplished in a number of ways. For instance, a company could promote using “lasting” resources to break the link between scarcity and economic activity by using only inputs that can be continuously reused, reprocessed, or renewed for productive use (e.g. renewable energy, biomaterial or fully recycled / recyclable resources). Or it could create more “liquidity” in markets by making products and assets more accessible and easy to convert between users—eliminating idle time and increasing the number of people who benefit from a given volume of goods. It could develop linked value chains, reclaiming and looping back waste outputs as useful inputs into a new production process. Or it could simply extend the useful life cycle of existing products.

To be sure, the intent of these circular value chains is nothing new. Many of

the underlying concepts of the circular economy—“cradle to cradle,” industrial ecology, biomimicry and others—have been around for decades and meritoriously explored by pioneers like Bill McDonough, Michael Braungart, Walter R. Stahel and Ellen MacArthur.

But what makes the circular economy so ripe for widespread adoption now are the disruptive technologies that allow massive change—change that would have been impossible only a decade ago. Change at speed and scale. One obvious example: the emergence of digital as a growing economic phenomenon around the world. Many companies have made great progress in adopting digital technologies to dramatically improve aspects of their business. Such efforts really only scratch the surface of what’s possible if one consider how companies can now also use social, mobile, machine-to-machine



communication, etc. to interact with the marketplace and products in use to analyze and optimize value chains, and create greater customer value.

Consider the case of connecting physical products to the digital grid. Remote access, monitoring, and information on a product's status and location—which used to require manual work to handle—is now available instantly. Transaction costs drop significantly¹⁶ since services can be provided only when needed and on the products that need them. Users can access products without interacting with a person, and products can “talk” to each other through machine-to-machine communication which enables, amongst other things, automatic management of systems of products or components.

When transaction costs are reduced and information availability increases (and economic activity is decoupled from

virgin resources), the need for a large-scale central organizing infrastructure is minimized, or decentralized. Business models can now be designed in new ways: Instead of focusing on large inventories of homogenous goods shipped and sold at central locations, a business model can be created, for example, that focuses on the customer and the products' use. Circular inputs used in production also tend to be more local (renewable energy, biomass, and waste streams) than linear inputs (oil, virgin metals, and minerals), further supporting decentralized business models focusing on a local chain of production, consumption and return.

In this new environment the unit cost of resources becomes less of a factor because instead of using additional resources to manufacture new goods, companies and customers use what's

already in the market. Focus shifts from producing things from virgin resources to transferring existing products between users and transforming used products into new ones.

¹⁵ Macroeconomic modelling of sustainable development and the links between the economy and the environment, ENV.F.1/ETU/2010/0033, Bernd Meyer, November 2011 (http://ec.europa.eu/environment/enveco/studies_modelling/pdf/exec_sum_macroeconomic.pdf)

¹⁶ Some argue costs will often go all the way down to zero, “speeding us to an era of nearly free goods and services.” See Jeremy Rifkin, *The Zero Marginal Cost Society: The Internet of Things, the Collaborative Commons, and the Eclipse of Capitalism*, Palgrave Macmillan, 2014 (<http://www.amazon.com/Zero-Marginal-Cost-Society-Collaborative/dp/1137278463>)



Five Business Models Driving the Circular Economy

At a conceptual level, then, there is a strong and intuitive business case behind the circular economy both in the short and long-term: What company wouldn't want to reduce its dependence on increasingly scarce and costly natural resources while turning waste into additional revenue and value and sharpening their customer insight and value proposition?

But at a practical level, it's not easy. The fact is most companies today are simply not built to capitalize on the opportunities the circular economy presents. Their strategies, structures and operations are deeply rooted in the linear approach to growth—it's in their DNA. That's why companies seeking the circular advantage will need to develop business models that are free of the constraints of linear thinking. These models are not just about doing 'less bad', but they are about

driving positive impact 'through growth'. That's a concept business and economies can get behind.

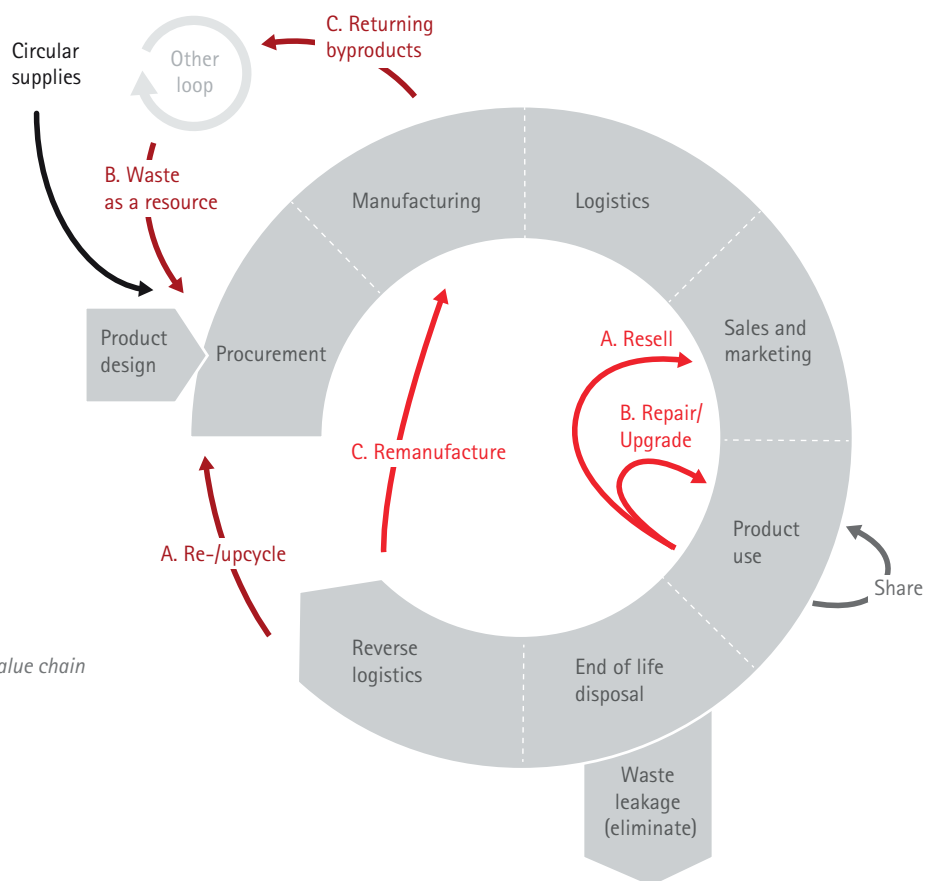
There are five underlying business models that Accenture has identified in its analysis of more than 120 case studies of companies that are generating resource productivity improvements in innovative ways (Figure 5).¹⁷

Figure 5: The five circular business models

Business Models

- **Circular Supplies:** Provide renewable energy, bio based- or fully recyclable input material to replace single-lifecycle inputs
- **Resource Recovery:** Recover useful resources/energy out of disposed products or by-products
- **Product Life Extension:** Extend working lifecycle of products and components by repairing, upgrading and reselling
- **Sharing Platforms:** Enable increased utilization rate of products by making possible shared use/access/ownership
- **Product as a Service*:** Offer product access and retain ownership to internalise benefits of circular resource productivity

* Can be applied to product flows in any part of the value chain



These business models have their own distinct characteristics and can be used singly or in combination to help companies achieve massive resource productivity gains and, in the process, enhance differentiation and customer value, reduce cost to serve and own, generate new revenue, and reduce risk.

Circular Supplies

The Circular Supplies business model is based on supplying fully renewable, recyclable, or biodegradable resource inputs that underpin circular production and consumption systems. Through it, companies replace linear resource approaches and phase out the use of scarce resources while cutting waste, and removing inefficiencies. This model is most powerful for companies dealing with scarce commodities or ones with a major environmental footprint.

Royal DSM¹⁸ is one player at the forefront of adopting the Circular Supplies business model to fuel its shift from a virgin material supplier to a company that reuses materials and provides new eco-friendly ones. One example: The company developed cellulosic bio-ethanol, a byproduct of co-fermenting sugars derived from crops. Such bio-based chemicals have great potential to reduce waste and net CO₂ emissions compared with fossil fuels. The cellulosic bio-ethanol has created a new revenue stream for DSM from a feedstock that was previously considered very low value, and the company anticipates it could eventually create upwards of 70,000 related jobs.¹⁹

Resource Recovery

Recovery of embedded value at the end of one product lifecycle to feed into another promotes return chains and transforms waste into value through innovative recycling and upcycling services. Having its bedrock in traditional recycling markets this business model leverage new technologies and capabilities to recover almost any type of resource output at a level of value equivalent to, or even above, that of the initial investment. Solutions range from industrial symbiosis to integrated closed loops recycling and Cradle-to-Cradle[®] designs where disposed products can be reprocessed into new. This model, which enables a company to eliminate material leakage and maximize economic value of product return flows, is a good fit for companies that produce large volumes of by-product or where waste material from products can be reclaimed and reprocessed cost effectively.

In the food sector, the Resource Recovery business model allows US grocery chain Kroger to convert food waste into renewable energy. The 150 tons of food waste the company produces each day at its Ralphps/Food 4 Less Compton distribution center—which used to be seen as a major cost in terms of lost revenue, disposal fees and emissions—now provides inexpensive, clean energy. That energy in turn powers a 49-acre campus that houses Kroger's offices as well as the distribution center.

The company relies on an “anaerobic digestion” system that converts food waste into biogas that runs the campus's microturbines and boilers replacing virtually all of the natural gas previously used. To date the initiative has yielded an 18 percent on Kroger's investment.²⁰

An example of a company that is recovering residual value potential in post-consumer product waste is carpet manufacturer, Desso. The company developed a separation technique called Refinity[®], which enables separation of yarn and other fibers from carpet backing. After a purification stage, this allows the yarn to be returned for the production of new yarn in a Cradle-to-Cradle[®] system.

¹⁷ In 2013–2014, drawing on primary and secondary research, Accenture analyzed business and economic models, technologies, capabilities, and customer value propositions of more than 120 circular economy case studies. The companies analyzed represented a wide range of geographies and industries, with the most prevalent being companies in Europe or North America and in the high tech, textiles, automotive and consumer goods industries.

¹⁸ For more on DSM's experience, see <http://poet-dsm.com>

¹⁹ David Hodes, “Advancing Biofuels,” GCXMag.com, April 10, 2013.

²⁰ Kroger (Ralphps/Food 4 Less), “Kroger Unveils A Clean Energy Production System Powered By Food Waste”, PRNewswire, May 15, 2013 (<http://www.prnewswire.com/news-releases/kroger-unveils-a-clean-energy-production-system-powered-by-food-waste-207588311.html>)

Product Life Extension

Product Life Extension allows companies to extend the lifecycle of products and assets. Values that would otherwise be lost through wasted materials are instead maintained or even improved by repairing, upgrading, remanufacturing or remarketing products. And additional revenue is generated thanks to extended usage. Using this model, a company can help ensure that products stay economically useful for as long as possible and that product upgrades are done in a more targeted way (for instance, an outdated component is replaced instead of the entire product). This model is appropriate for most capital-intensive B2B segments (such as industrial equipment) and B2C companies that serve markets where pre-owned products (or "recommerce") are common or whose new releases of a product typically generate only partial additional performance benefits for customers over the previous version.

By embracing the Product Life Extension business model, Google is addressing the obsolescence challenge in the mobile phone arena: What to do with devices when they no longer suit a customer's needs? The company's Project Ara initiative focuses on reinventing the smartphone by breaking it down into replaceable modules that can be assembled and customized according to user requirements. With the ability to swap modules, users can easily alter their phone with basic skills and tools (thus keeping the phone relevant for a longer period of time) and repair the phone more easily and inexpensively by replacing only what is broken instead of the entire phone. By maximizing a phone's useful lifetime, Google reduces the need for virgin resources to make new phones while minimizing the amount of E-waste generated. A possible complement to this design principle could be an online marketplace where users can trade phone modules to extend the lifecycle of components and recapture residual value.²¹

Sharing Platforms

The Sharing Platforms business model promotes a platform for collaboration among product users, either individuals or organizations. These facilitate the sharing of overcapacity or underutilization, increasing productivity and user value creation. This model, which helps maximize utilization, could benefit companies whose products and assets have a low utilization or ownership rate. However, today it's most commonly found among companies specializing in increasing the utilization rate of products without doing any manufacturing themselves, putting considerable stress on traditional manufacturers.

Ride-sharing company Lyft, Inc. is revolutionizing one segment of the travel market with the Sharing Platforms business model. Lyft's co-founders realized that cars making trips within cities were vastly underutilized; they estimated 80 percent of seats were empty. The company helps fill those seats by enabling, via its mobile app, individuals who need a ride somewhere to request one from someone who has a car. Pickup and ride fee (typically 20 percent to 30 percent lower than a comparable taxi fare) is paid through the app, of which Lyft takes a 20 percent cut.²² The business model appears to resonate not only with customers but with investors as well: The company in April 2014 announced a new round of funding worth \$250 million (for a total of \$333 million thus far), which the company says will help fuel Lyft's ongoing domestic—and, eventually, global—expansion.²³

Product as a Service

The Product as a Service business model provides an alternative to the traditional model of "buy and own." Products are used by one or many customers through a lease or pay-for-use arrangement. This business model turns incentives for product durability and upgradability upside down, shifting them from volume to performance. With a Product as a Service business model, product longevity, reusability, and sharing are no longer seen as cannibalization risks, but instead, drivers of revenues and reduced costs. This model would be attractive to companies whose products' cost of operation share is high and that have a skill advantage relative to their customers in managing maintenance of products (giving them an edge in selling services and recapturing residual value at end of life).

Michelin, one of the world's leading tire manufacturers, has made significant strides toward adopting the Product as a Service model to create an innovative program in which fleet customers can lease instead of purchase tires outright. Under this program, Michelin effectively sells "tires as a service." Customers pay per miles driven. They don't own the tires. And don't have to deal with the hassles of punctures or maintenance of any kind.²⁴ By adopting a Product as a Service model, Michelin is incentivized to develop longer lasting tires. And, by getting worn-out tires back, the company is motivated to make sure through design and material selection that they can be reprocessed into a valuable input for new tires or something completely different.

Circular business models are disrupting industries around the world. In fact, our research revealed successful adoption of these business models has exploded in the past decade. Take Airbnb for example. The company allows users to rent rooms or entire homes from members through an online site. Founded in 2008, the company has overtaken both InterContinental Hotels and Hilton Worldwide as the largest hotelier (offering more than 650,000 rooms) and has been growing bookings and revenues several hundred percent per year. And electronics reseller Gazelle, founded in 2006, was seven years later going for \$100 million in revenue in a \$7 billion US market for consumer electronics "re-commerce" by leveraging the Product Life Extension model.²⁵

Initially, market disruption through circular business models was driven by startups. Now large multinationals are making serious moves as well. H&M collect garments in all stores to close the textile loop, BMW and Cisco Systems are extending the life of used products through refurbishment and resale, Philips offer "light as a service" to cities and municipal governments, Amazon.com textbooks as a service, Daimler's Car2Go (a car sharing service) had 600,000 customers in 2014 heading for \$100 million in revenue and Wal-Mart²⁶ is making a push into the \$2 billion market for pre-owned videogames through an in-store trade-in program.

Another interesting development around circular economy: the emergence of ecosystems forming around pioneering organizations—both start-ups and long-established firms. One of the best examples: carpet manufacturer Interface. Long a pioneer of circular practices and on a mission to achieve its goal of zero negative impact, Interface created a network of circular business partners. From return chain sourcing to more sustainable installation practices, it relies on its network of circular economy business partners to help drive innovation and jointly develop new solutions to deliver on Interface's zero negative impact aspiration.

Similarly, drinks manufacturer Carlsberg Group and a subset of its global suppliers have joined forces to develop the next generation of packaging optimized for recycling and reuse while, at the same time, retaining or improving quality and value. The cooperation has been formalized through the "Carlsberg Circular Community," which has set targets to include 15 partners and have at least three products Cradle-to-Cradle[®] certified by 2016.²⁷ At an Accenture event at the World Economic Forum in 2014, Jørgen Buhl Rasmussen, Carlsberg's CEO, said: "I see there is a business case, it's in the interest of consumers and also of the planet and society".²⁸

²¹ Project Ara (<http://www.projectara.com/>)

²² From the Lyft entry in Wikipedia (<http://en.wikipedia.org/wiki/Lyft>)

²³ The Tech Chronicles, "Lyft snares \$250 million for U.S., international growth," SFGate, April 2, 2014 (<http://blog.sfgate.com/techchron/2014/04/02/lyft-snares-250-million-for-u-s-international-growth/>)

²⁴ Michelin Fleet Solutions (<http://www.michelintruck.com/michelintruck/services/MichelinFleetSolutions.jsp>)

²⁵ Gregory T. Huang, "Gazelle, Apple, and Amazon: The Future of 'Recommerce,'" Xconomy, October 22, 2013 (<http://www.xconomy.com/boston/2013/10/22/gazelle-apple-amazon-future-recommerce/>)

²⁶ Walmart, "Walmart Doubles Down on Video Gaming," corporate news release, March 18, 2014 (<http://news.walmart.com/news-archive/2014/03/18/walmart-doubles-down-on-video-gaming>)

²⁷ Carlsberg, "Carlsberg joins forces with suppliers to eliminate waste by developing next generation of packaging for high-quality 'upcycling,'" January 21, 2014 (<http://www.carlsberggroup.com/investor/news/Pages/Carlsbergjoinsforceswithsupplierstoeliminatewastebymdevelopingnextgenerationofpackagingforhigh-quality%E2%80%98upcycling%E2%80%99.aspx>)

²⁸ The launch of The Circulares, Accenture YouTube channel, <http://www.youtube.com/watch?v=L6gE4jycbbM>



Ten Transformational Technologies Make Circular Business Models Possible

Business model innovation offer companies powerful options for embracing the circular economy. But many of the models, if not most, would not be possible without the support of innovative new technologies—especially digital ones such as social, mobile, analytics, cloud and 'machine to machine' technologies (e.g. the wirelessly connected internet of things not just people). Designing value chains to

embed circular business models all the way through to the customer's use and return is a major new frontier for digital that revolutionizes levels of service and flexibility, when the physical and digital worlds merge and products start to flow between users, markets, and lifecycles at very low transaction costs.

In our research we identified 10 disruptive technologies commonly used by the leading circular economy companies (Figure 6). These technologies fall into three categories: digital (information technology), engineering (physical technology), and hybrids of the two.

Figure 6: Disruptive technologies used by pioneers to launch and operate circular business models with speed and scale

		Circular Supplies	Resource Recovery	Product Life Extension	Sharing Platforms	Product as a Service
Digital	Mobile			2	3	
	M2M				2	2
	Cloud				2	2
	Social			1	3	2
	Big Data Analytics	1			2	3
Hybrid	Trace and return systems		2	3	1	
	3D Printing	1		2		
Engineering	Modular design technology		1	1		1
	Advanced recycling tech	1	2			
	Life and Material sciences	2	1			

*Based on 120+ case studies and 50+ interviews

Number of icons in respective boxes indicate relative importance

Digital technologies play an important role in establishing real-time information exchanges among users, machines and management systems. These technologies are intrinsically customer-focused and provide the information and connections needed to maintain a relationship far beyond the point of sale. Two examples in telecommunication are Vodafone and Verizon which, through in-mobile functionality and analytics, enable customers to automatically get a quote for the buy-back value of a used phone and support in returning the phone to a nearby store for instant reimbursement.²⁹

Such connections enhance remote visibility and control of assets, which are especially critical for the Product as a Service, Sharing Platforms and Product Life Extension business models. By altering the way businesses and consumers interact with physical and digital assets and enabling dematerialization, digital technologies can transform value chains so they are decoupled from the need for additional resources for growth.

Another example is vintage fashion marketplace Poshmark, (Product Life Extension) which moved its entire shopping experience and store to a mobile device. The company leverages social media and analytics to optimize the shopping experience for millions of customers by providing real-time advice. It also uses technology to, for example, stage collaborative real-time shopping events, some of which have attracted more than 50,000 participants at a time.³⁰

The combination of digital technology and circular thinking can indeed be powerful in reshaping value chains. This is not always without friction as established norms and players might resist change during a transition.

When tens of thousands of taxi drivers in Europe went on strike in June 2014, protesting against digitally powered Sharing Platform Uber, the power of the transformation became very clear.³¹ While concerns from people who are being challenged by circular economy technologies need to be taken seriously, delaying change is a road to nowhere. On the day of the strikes, Vice-President of the European Commission, Neelie Kroes, commented that: "Whether it is about cabs, accommodation, music, flights, the news or whatever. The fact is that digital technology is changing many aspects of our lives. We cannot address these challenges by ignoring them, by going on strike, or by trying to ban these innovations out of existence ... [We] need services that are designed around consumers. The old way of creating services and regulations around producers doesn't work anymore."³²

Engineering technologies—including advanced recycling, modular design, and life and material sciences—enable the manufacturing of new goods from regenerated resources, as well as the actual collection, return, and processing of goods and materials and cost-efficient collection of used assets for remanufacturing. Making these technologies especially important for running Circular Supplies and Resource Recovery models.

Hybrid technology is partly digital and partly engineering. It can establish a unique type of control over assets and material flows. It allows a company to digitally identify the history, location, status and application of materials and goods while, at the same time, support ways to physically collect, treat and reprocess them. For example, 3D printing allows for the local manufacturing of downloadable digital designs into physical objects—which is what Chinese company Winsun New Energy Co., has done. The company uses 3D printing

to print houses in less than a day using recycled material—at a cost of less than \$5,000 per home.³³

Trace-and-return systems, like those by Scanimetrics, represent another key hybrid solution. Scanimetrics offers hardware, software and support for condition monitoring that is vital for low-cost predictive maintenance and repair/remanufacturing chains.³⁴ Hybrid technologies play an important role in supporting Circular Supplies, Resource Recovery, and Product Life Extension models, serving as the bridge between the digital and physical worlds.

²⁹ Kevin White, "Verizon Wireless Puts Smartphone Recycling in the Palm of Your Hand," Verizon Wireless, April 17, 2014 (<http://www.verizonwireless.com/news/article/2014/04/smartphone-recycling-device-trade-in.html>) & Vodaphone Buyback (<https://vodafonebuyback.co.uk/>)

³⁰ For more Accenture insights on digital disruption, see "Accenture Technology Vision 2014"

(<http://www.accenture.com/microsites/it-technology-trends-2014/Pages/home.aspx>) and "Growth Strategies for a Digital World"

(<http://www.accenture.com/SiteCollectionDocuments/PDF/Accenture-Growth-Strategies-For-Digital-World.pdf>)

³¹ Karyne Levy, "A Chinese Company 3-D Printed 10 Houses in a Day," Business Insider, April 14, 2014 (<http://www.businessinsider.com/a-chinese-company-3d-printed-10-houses-in-a-day-2014-4#!183Z0>)

³² <http://www.scanimetrics.com/>

³³ Frans Van Houten, "The Circular Revolution," Project Syndicate, January 21, 2014 (<http://www.project-syndicate.org/commentary/frans-v--houten-calls-for-a-shift-toward-a-new-economic-model--based-on-the-use-of-goods-that-consumers-do-not-own#QudycVXfyHLLGMk5.99>)

³⁴ Kingfisher, "The Business Opportunity of Closed Loop Innovation" (https://www.kingfisher.com/netpositive/files/downloads/kingfisher_closed_loop_innovation.pdf)

Five Capabilities of Successful Circular Leaders

Along with new technologies, new capabilities are essential for adopting a circular approach. From our research, five stand out as particularly important for successful implementation:

At the highest level, operating in a circular economy requires a significant change in **business planning and strategy**. From focusing on maximizing throughput and sales margin to participating in continuous product and service loops to boost revenue. Doing this requires not only concentrating on a narrow definition of the core business, but also participating in collaborative circular networks (Figure 7) engaging suppliers, manufacturers, retailers, service suppliers and customers. It's vital to engage the full circular chain in one way or another to understand where and how value is really created and build up activities around that. For Philips' CEO Frans van Houten, such a shift is fundamental to Philips' embrace of the circular economy. "My company is redesigning its products and considering how to capture their residual value," he noted. "At the same time, it is shifting from a transaction-based business model—one that entails closer cooperation with customers and suppliers."³⁵

Innovation and product development are different in a circular economy, as focus shifts from designing for single use to designing for many life cycles and users while optimizing the environmental effects of the materials used. Adapting products to generate revenues not only at point of sale but also during use (e.g. maintain, upgrade, and share) as well as low-cost return chain and reprocessing (e.g. modularity, traceability, and standardization) are key design challenges. On the software end companies often need to mature

PLM capabilities by expanding system definition and scope to repair, in-service and return activities. Major players are now using the circular economy as a driver for innovation, as typified by retailer Kingfisher. "For me, one of the most exciting things about closed loop innovation is that this is going to drive the next generation of business growth," said the company's CEO, Ian Cheshire. "Our target is to get to 1,000 products with closed-loop credentials by 2020."³⁶

In sourcing and manufacturing, companies need to consider whether material inputs for product designs are renewable or fully restorable, as well as their environmental footprint and toxicity. And they will have to make sure that production is not only efficient, but that no resources are lost during the process and that the company can significantly scale up and maintain sourcing volumes from return chains. The latter often means shifting from large-scale sourcing from few suppliers to sourcing from many, heterogeneous and small-scale sources. This requires flexibility in production so that inputs of different qualities and origins can be used in production of valuable products, instead of dumped or incinerated. One leader in circular sourcing and manufacturing is furniture retailer, IKEA. One of the company's stated corporate goals is to "strive for resource independence by using resources within the limits of the planet and by encouraging all waste to be turned into resources."³⁷ In pursuit of this goal, the company has committed to, by the end of FY15, having all of its main home furnishing materials be made from either renewable, recyclable or recycled materials.³⁸

On the customer-facing side, **sales and marketing** will have to complement their chief focus on generating demand and fulfilling customer requirements with generating greater revenues from the use of products and services instead of the purchase of them. They also need to develop new ways to engage and incentivize customers to use and dispose of their products properly, especially if adopting service-based models where customers no longer have direct ownership of products and, as a result, less incentive to take proper care of them. Likewise, aftersales service will continue to support service levels, sell spare parts and manage channel partners, but will also have to become a much more active participant in managing the lifecycle of the product and maximizing its retained value. All-in-all, in a circular economy, sales and marketing is all about deepening the understanding of the use phase of products and feeding back revealed preferences from the markets so that products and services can be adapted for circular use.

At the end of the process—holding the entire loop together—are **reverse logistics and return chains**, or disposal and collection. Reducing logistics and waste management cost, retaining customers with good return programs, and complying with government regulations will continue to be key concerns for this function. But it also must be effectively designed to manage opportunity-driven take-back/buy-back from the markets and facilitate local reuse. A key capability, then, is quality control and determining the optimal return and reprocessing chain.

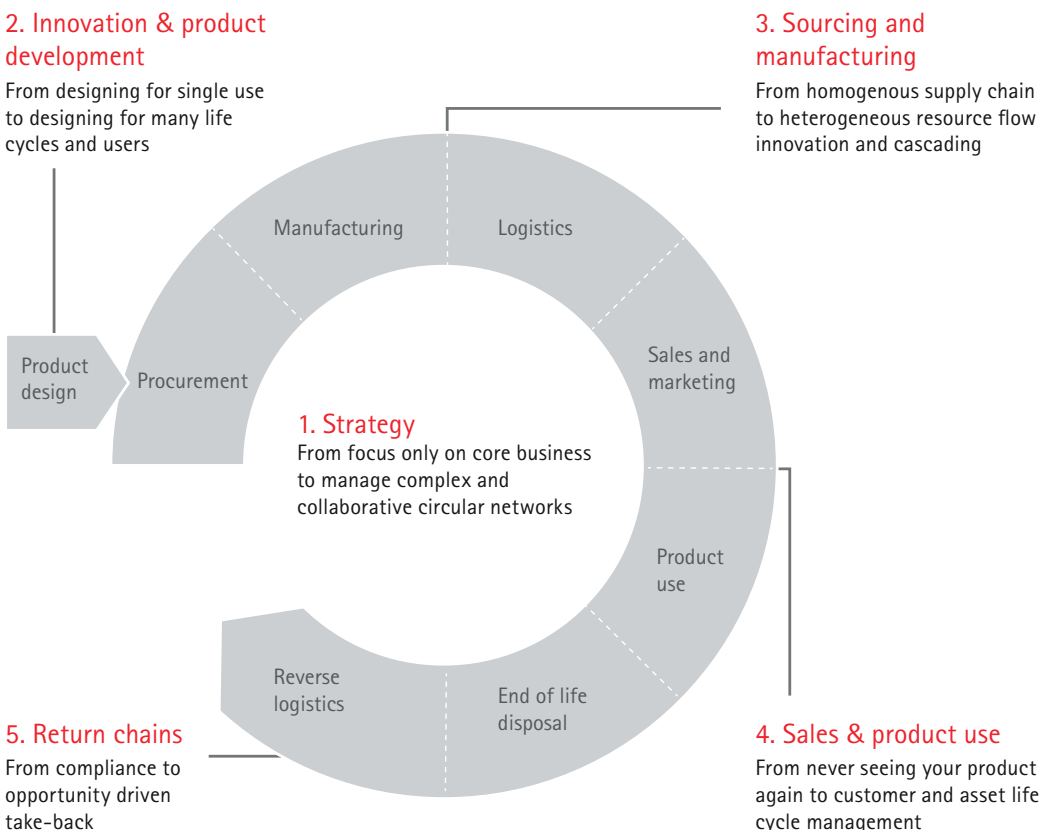
³⁵ IKEA Group, "IKEA Group Sustainability Report FY12" (http://www.ikea.com/ms/en_IE/pdf/sustainability_report/IKEA_Group_Sustainability_Report_FY12_FINAL.pdf)

³⁶ Ibid.

³⁷ Accenture, "Accenture CEO Study on Sustainability 2013," 2014 (<http://www.accenture.com/microsites/ungc-ceo-study/Pages/home.aspx>)

³⁸ European Commission, "European Commission Efficiency Platform" (http://ec.europa.eu/environment/resource_efficiency/documents/erep_manifesto_and_policy_recommendations_31-03-2014.pdf)

Figure 7: Core capability shifts supporting circular business model adoption



New Systems Enablers & Policies Needed for the Circular Economy to Scale at Speed

While companies obviously are key to fostering the shift to a circular economy, governments play a no less important role. Indeed, successfully tackling a systemic reshaping of the production and consumption model that has dominated the past 250 years requires a tight alignment of supply, demand and policy. This means governments must use their powers to shape market conditions at the national and even global level to create the right conditions for change. It also means them adopting the circular economy in their own substantial organizations and supply chains through areas like public procurement.

According to a recent Accenture and United Nations study, 83 percent of business executives believe governments need to step up their efforts to provide an enabling environment for business efforts on sustainability. These CEOs also believe that only with greater government intervention—at global, national and local levels—can sustainability move from sporadic, incremental advances to a collective and transformative impact. They also want clear policy and regulation that can provide long-term investment stability to accelerate the pace of change and greater investment. And they call for active intervention by governments and policymakers (in collaboration with business) to align public policy with sustainability at global, national and local levels—including enacting important measures on regulation, standards, and taxation.³⁹

Some governments are taking initial steps to that end. For instance, the European Union's European Resource Efficiency Platform lays out policy recommendations and actions to help Europe move to a circular economy (and, in the process, reduce the total material requirements of

its economy by 17 percent to 24 percent, thus boosting GDP and creating between 1.4 and 2.8 million jobs).⁴⁰ Similarly, the government of China recently launched the China Association of Circular Economy (CACE)—which includes government officials, academicians and entrepreneurs—to promote the growth of circular economy in that country.⁴¹ Another example from Asia is the Singapore Packaging Agreement (SPA), a joint initiative by the government, private sector and non-governmental organizations to reduce packaging waste from consumer products and the supply chain, saving almost 20 million USD over five years on locally consumed products.⁴² In the US circular economy is supported for example by the "BiopREFERRED" public procurement program with the goal to increase the development, purchase and use of biobased products through procurement preference by Federal Agencies and their contractors, and voluntary product certification and labeling for consumers.⁴³

Governments in general still need to make much greater—and more rapid—progress in creating a policy environment that nurtures circular business models. Policies like: shifting taxation from labor to resources, setting specific recycling targets for industries, making companies responsible for products throughout their life cycle, implementing tax premiums for the use of regenerated resources, and creating an international standard definition of waste. All are needed to make circular thinking the de facto way of doing business in the future.

And governments can serve as both catalysts for circular economy innovation and as role models in adopting circular business models, reducing their own reliance on natural resources in the materials they purchase.

³⁹ "China to promote circular economy," China Daily, December 2, 2013 (http://www.chinadaily.com.cn/bizchina/greenchina/2013-12/02/content_17144815.htm)

⁴⁰ Singapore Government, Waste Minimization and Recycling (<http://app2.nea.gov.sg/energy-waste/recycling/waste-minimisation-and-recycling>)

⁴¹ USDA, "BiopREFERRED program overview" (http://www.biopREFERRED.gov/files/BP_Fact_Sheet_HR.pdf)

⁴² Singapore Government, Waste Minimization and Recycling (<http://app2.nea.gov.sg/energy-waste/recycling/waste-minimisation-and-recycling>)

⁴³ USDA, "BiopREFERRED program overview" (http://www.biopREFERRED.gov/files/BP_Fact_Sheet_HR.pdf)





Conclusion – Key Set of Questions that Kick-off the Journey towards Circular Advantage

Accenture research and client experience, as well as that of several others recently, paints a compelling business case for a move away from the current linear growth model to a circular one. And, in fact, efforts by leading companies suggest this change is already happening, is successful, and is inevitable. That's why it is important for organizations—regardless of market, geography or industry—to begin laying the foundation for change. By doing so, they can initiate the transition to a new way of doing business that radically improves resource productivity, enhances differentiation, reduces costs and risks, creates robust new revenue streams, and enhances the customer value proposition.

So what does it take to get started? Addressing the following five key set of questions can help CEOs and top executives frame the issues surrounding the journey toward circular advantage in their own organizations:

1. Opportunity: Where are the opportunities for adopting circular economy approaches in our value chain and what can be done to shape our company's journey?

Understanding where the shift to circular will destroy and create value needs to be the starting point for any organization. That includes understanding specific drivers and available technologies. The primary catalysts for creating a case for change are not the same for every country and industry. They range from resource supply scarcity to technological disruption and consumer behavior, each impacting companies to a greater or lesser extent based on their particular business. So there's no one-size-fits-all solution. The first thing companies should do is truly understand their exposure towards the future risk of operating in a linear fashion asking: What percentage of our cost base is resource related?

How big are the inefficiencies in the circular value chain? Combine that with a view of whether your competitors have begun to move toward circular and you build an understanding from which your company's journey can be shaped. Strategic options range from input substitution, resource efficiency and recycling, to product longevity, transforming products into services and using digital to enable customers to go circular. Depending on the chosen path there are also operational issues to consider when it comes to the journey itself. Should the primary focus be on engaging the supply chain and operations to deliver on goals? Or in building new alliances with customers to launch initiatives in the markets?

2. Value: What's the real core value and essence of what we deliver to customers, and how can circular business models help us rethink how we deliver that value?

It's common for circular economy pioneers to see their customers as users rather than consumers of products and services. Switching perspectives requires a focus on what functionality you provide that truly brings value to the customer. And implies a continuous, multi-lifecycle, view on the customer relationship. It often requires taking an unconventional view of the commercial and ownership model. The five new circular economy business models all have unique ways to protect embedded value in a product, component, material or process. They each represent a differentiated strategic option in themselves with implications regarding the product development path of your business and its future core customer value proposition. One of the first choices to make is whether to adopt a pure play, blend two or more of the business models or instead operate as an enabler for other companies in taking their circular offerings to market.

3. Capabilities: What improvements will we need to make to our operating model and capabilities to support a circular economy business model and customer proposition?

Naturally each circular business model requires a specific configuration of existing and new capabilities to function optimally. Which of the key capabilities discussed in this paper—business planning and strategy, innovation and product development, sourcing and manufacturing, sales and marketing and return chains—should be prioritized? What corresponding key activities, partners, cost drivers, revenue streams and customer relations need to be managed accordingly? Another key decision: What part of the circular value chain stays in-house? And what portion should be outsourced? Piloting and learning new approaches along each link of the value chain will work best for some businesses—from design to manufacturing, retail and reverse logistics. For others, the optimal strategy will be to focus on, and master, a limited set of capabilities. Building capabilities inevitably takes time and costs money. Companies that cannot manage this investment up front must find short-term revenue streams to finance the change while moving in the right direction. This means that your business model will likely need to evolve over time as capabilities are built and the right market conditions mature.

4. Technology: What are the technology trends – science, engineering and digital that really matter to our business when it comes to circular economy and what is their potential to disrupt the value chain?

When a value chain moves toward circular practices, the dynamics of competitiveness and power transform through disruptive technologies like analytics, mobile, advanced recycling technology, etc. Value chains will converge and in some industries traditional upstream and downstream activities will merge. In others customers will become significantly more powerful, more mobile and more demanding. Manufacturers become retailers and retailers become digital social communities. When choosing the right positioning and technology infrastructure amidst this upheaval it's vital to define the technology set that best suits your strategy and circular business model. Once decided there are a number of strategic options for securing technological capabilities including: buy through M&A or joint ventures, etc. build through organic investments, and "borrow" through collaboration with other partner companies. In driving change it is vital to ensure a link between the technology roadmap put forward by the CTO and the requirements that come with your circular business model. Ensuring collaboration between technology, sustainability and marketing departments is crucial to allow for the right type of innovation.

5. Timing: How do we time our initiation and adoption rates and the level of ambition of our circular economy approaches to create a portfolio and give us options and agility?

Some of the most attractive circular opportunities will take time and resources to pursue. What about quick wins? They may not create sustained advantage. The move to a circular economy is so profound that once the "platform is burning" it might already be too late. That's why it's important to lay the groundwork for future possibilities before they're realities. Timing your move is all about striking the delicate balance between first mover advantage (technology leadership, securing scarce resource supply, creating switching costs, addressing undiscovered customer needs, etc.) and disadvantage (free rider effects, betting on the wrong technology, failing to build capabilities, policy changes, etc.). Key strategic options are a stepwise building of a dedicated circular customer base versus working with the entire existing base from the start. Striking the investment strategy balance between organic/inorganic/partnerships. And choosing when to hedge bets in a portfolio vs. when to transform the core business altogether. Often you'll need to work on parallel tracks: gradually improving the circularity of your business while testing selectively where to go "all-in" at speed and scale.

Moving toward a circular economy can be daunting. Yet, by adopting circular economy principles, more and more companies are gaining real competitive advantage: Getting ahead of rivals by innovating for both resource efficiency and customer value—and creating change at the intersection of a company's strategy, technology and operations.

In the face of runaway resource scarcity and rising customer and policy expectations for better, more sustainable products, there's never been a better time to start. By developing a proactive strategy—built on a clear understanding of the motivation to leave behind the linear model and underpinned by the business models, technologies and capabilities critical to success—companies can create superior value and capture advantage - Circular Advantage.

About Accenture

Accenture is a global management consulting, technology services and outsourcing company, with approximately 289,000 people serving clients in more than 120 countries. Combining unparalleled experience, comprehensive capabilities across all industries and business functions, and extensive research on the world's most successful companies, Accenture collaborates with clients to help them become high-performance businesses and governments. The company generated net revenues of US\$28.6 billion for the fiscal year ended Aug. 31, 2013. Its home page is www.accenture.com.

Accenture Circular Economy

Accenture is helping our clients deliver 'Circular Advantage' at the intersection of strategy, technology and operations around the world. As well as our deep insight from a range of client projects across sectors, we are also driving significant research programs and partnering with some of the world's leading organizations such as the World Economic Forum, the Young Global Leaders Forum and Oxford University amongst others on the transition and transformation required to create a Circular Economy.

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