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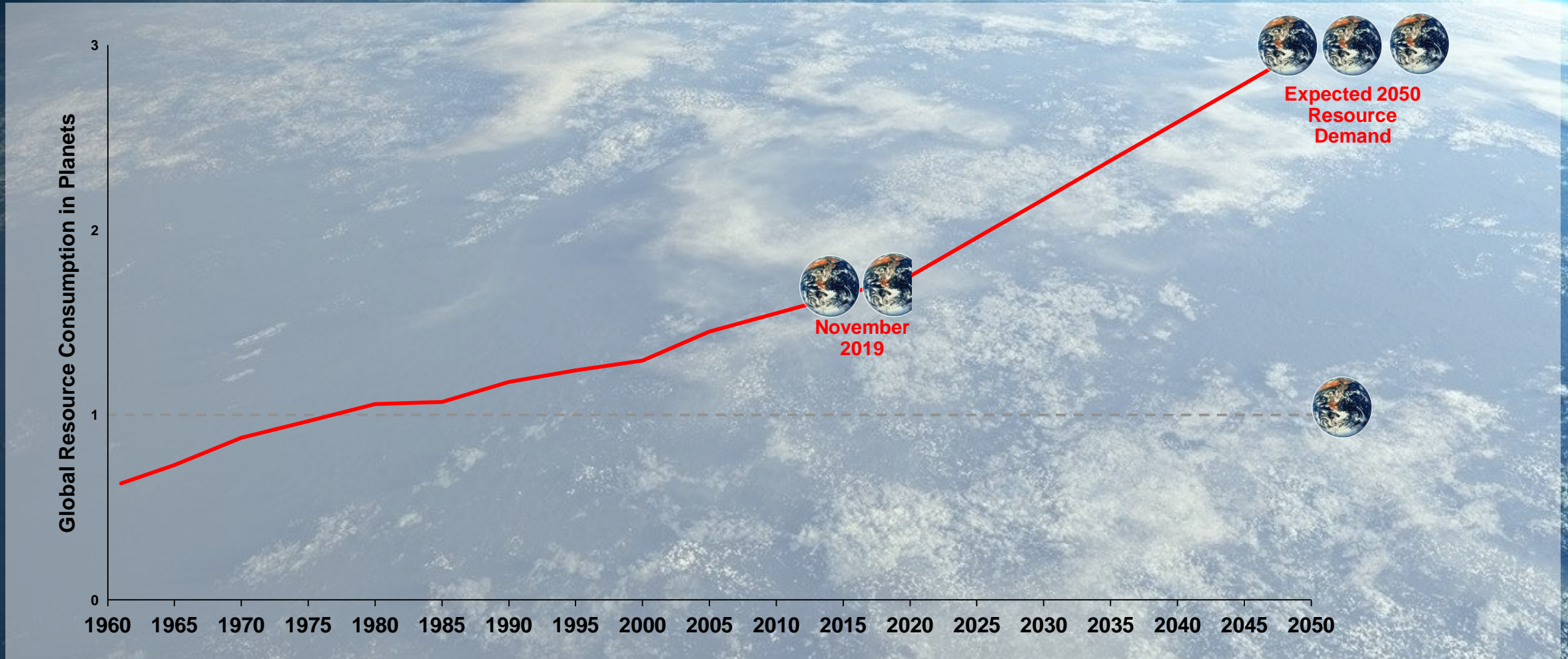
THE CIRCULAR ADVANTAGE: SCRAP TIRES' OPPORTUNITY TO FUEL ECONOMIC GROWTH & SUSTAINABILITY

Scrap Tire Research and Education Foundation Conference

**Pasha Ponomarev
December 4, 2019**

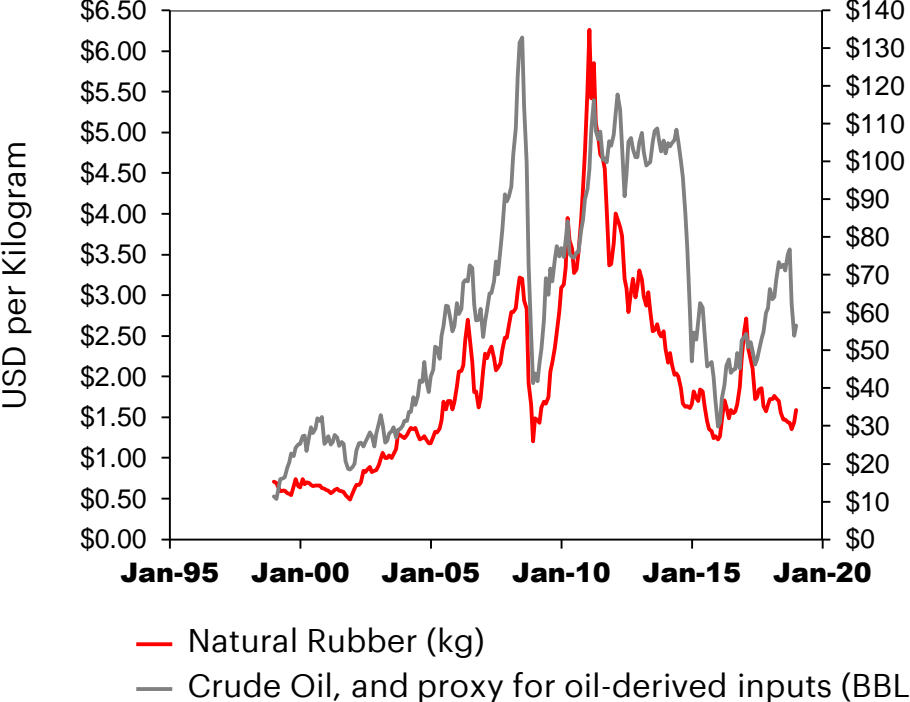
CONTINUING OUR 1:1 RELATIONSHIP BETWEEN GROWTH AND RESOURCES WOULD REQUIRE 3 PLANETS BY 2050

WE MUST DECOUPLE GROWTH FROM RESOURCE USE



THE TIRE INDUSTRY IS FACING RISKS IN RESOURCE AVAILABILITY, RISING COMMODITY PRICES, AND REGULATORY VOLATILITY

Commodity Prices Impacting Tire & Scrap Market (USD)



Global Trade Disputes, and Country Turmoil Impact the Supply Chain

China to slap 10% tariff on US synthetic rubber, tire products

Singapore — The synthetic rubber and tire market are being pulled into the US-China trade war, with China set to enforce a 10% tariff on various synthetic rubber and tire products originating in the US or Canada by Monday, according to China's Ministry of Commerce.

Deep In The Amazon, An Unseen Battle Over The Most Valuable Trees

November 4, 2015 - 4:21 AM ET
Heard on Morning Edition

Goodyear posts income drops, cites sales volumes, higher raw materials costs as reasons

TIRE BUSINESS REPORT



Rising costs for materials & energy



High commodity market volatility



Economic & social risk of supply disruptions

Source: Accenture Strategy
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TO DECOUPLE, WE NEED TO IDENTIFY & ELIMINATE SOURCES OF WASTE IN OUR CONVENTIONAL LINEAR PROCESSES



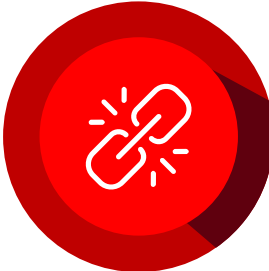
1. Wasted resources

Use of material and energy that **cannot be effectively regenerated over time**, such as fossil energy and non-recyclable material



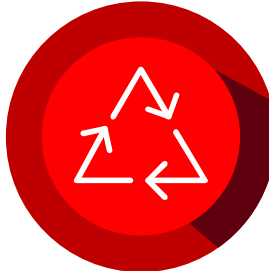
2. Wasted capacity

Products and assets that are **not fully utilized** across their useful life



3. Wasted lifecycles

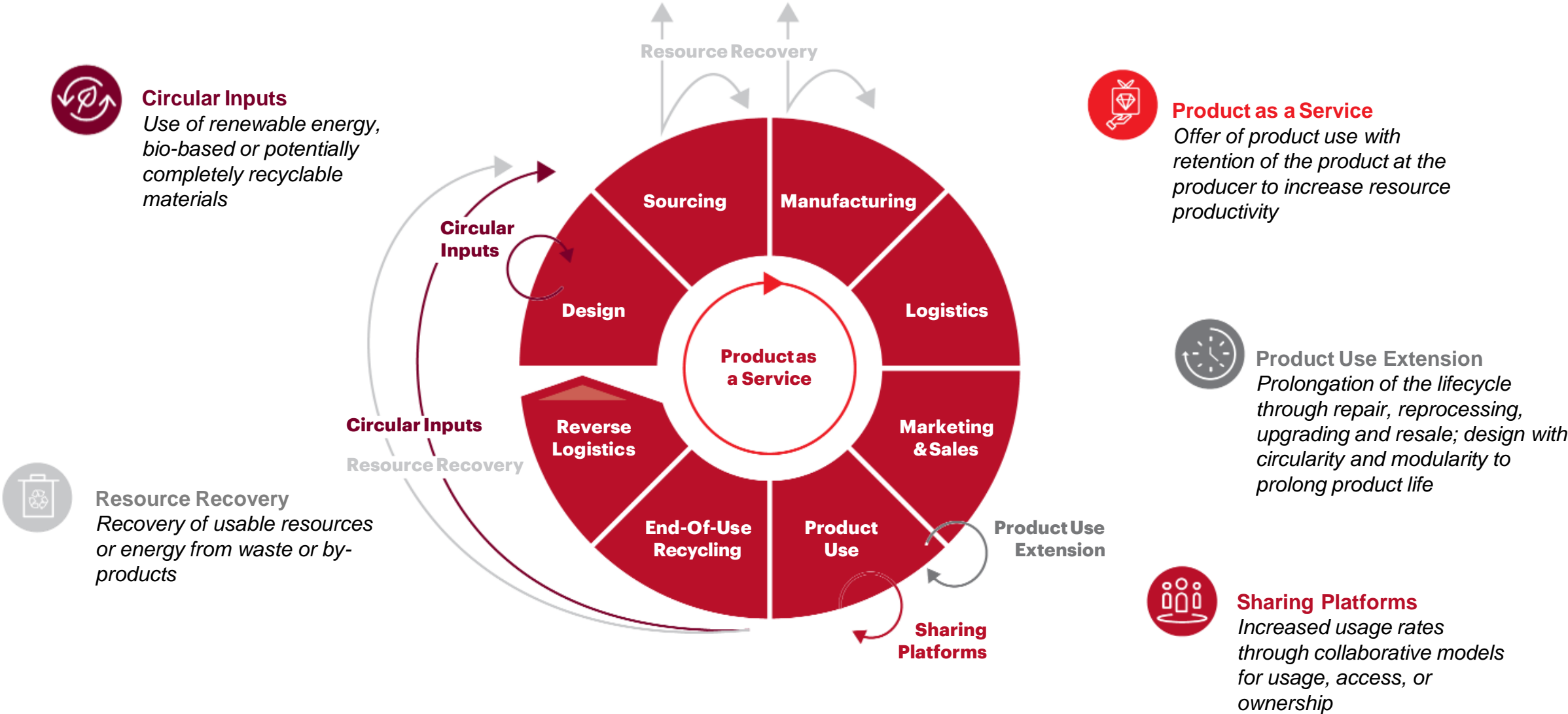
Products **reaching end of life prematurely** due to poor design or lack of second life options



4. Wasted embedded value

Components, material and energy **not recovered** from waste streams

CIRCULAR BUSINESS MODELS CAN BE USED AS A LENS FOR VALUE CREATION



CITIZENS AND CONSUMERS ARE CALLING FOR CIRCULARITY

Consumers have strong view on the role of business, and they are looking to be part of the solution.

84%

Of consumers rate sending waste to landfills as the disposal method that is most harmful to the environment

83%

Of consumers believe it is important for companies to design products that are meant to be reused or recycled

62%

Of consumers want companies to take a public and passionate stance on social, cultural, environmental and political issues

43%

Of consumers have participated in a product takeback program with 74% indicating that participation would be most encouraged by convenient returns or incentives

37%

Of consumers rank environmental impact as one of their top 5 considerations before making a product purchasing decision

36%

Of consumers are willing to pay more for a product that was made from recycled materials

50%

Of consumers are willing to pay more for a product that was designed to be reused or recycled

7%

Of consumers have stopped buying automotive products due to environmental concerns

LEADING COMPANIES & GOVERNMENTS ARE MANDATING CHANGE FROM THE TOP DOWN

ILLUSTRATIVE / NON-EXHAUSTIVE



Michelin 2048 goals: tires made with 80% sustainable material and 100% tire recycling



Michigan awards grants to boost tire recycling

State's Department of Environment, Great Lakes and Energy awards more than \$1.2 million in grants to 72 applicants.

November 4, 2019



Volvo Cars to Use 25% Recycled Plastics by 2025



Sheridan's 'Pay-As-You-Throw' Program To Begin Next Month

By CATHERINE WHEELER • OCT 28, 2019



Apple makes "closed loop" recycling pledge

Apple Promises to Make iPhones From Only Green Materials and Stop Mining. Soon



Ontario's new 'zero waste' strategy geared toward circular economy model



U.S. Plastics Resin Producers Set Circular Economy Goals To Recycle Or Recover 100% Of Plastic Packaging By 2040



California assembly passes tire recycling bill

Assembly Bill 2908 develops an incentive payment system to fund recycling end uses for tires.

August 28, 2018



Johnson Controls finalist for circular economy honor

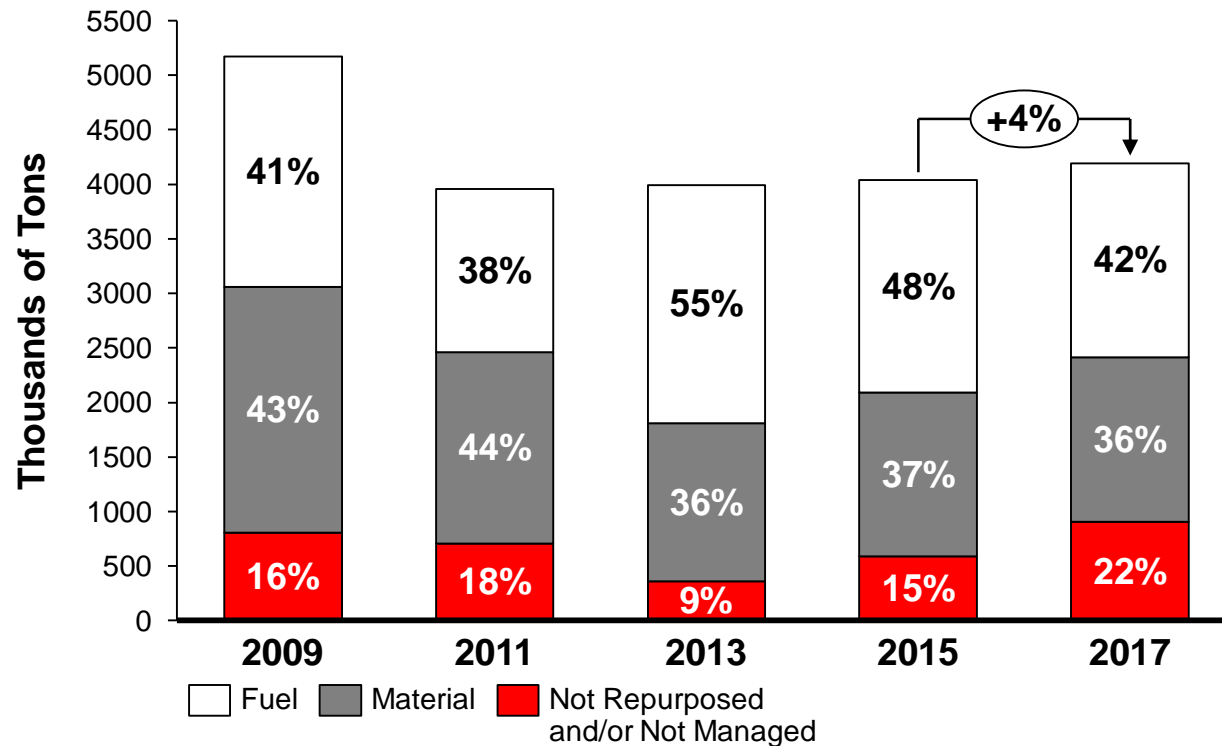


Phoenix's \$13 million plan to turn trash into cash

By Colleen Kane July 16, 2015

SCRAP TIRE MARKET HAS A CLEAR OPPORTUNITY TO ADOPT CIRCULAR BUSINESS MODELS

U.S. Scrap Tire Use Trends 2009-2017



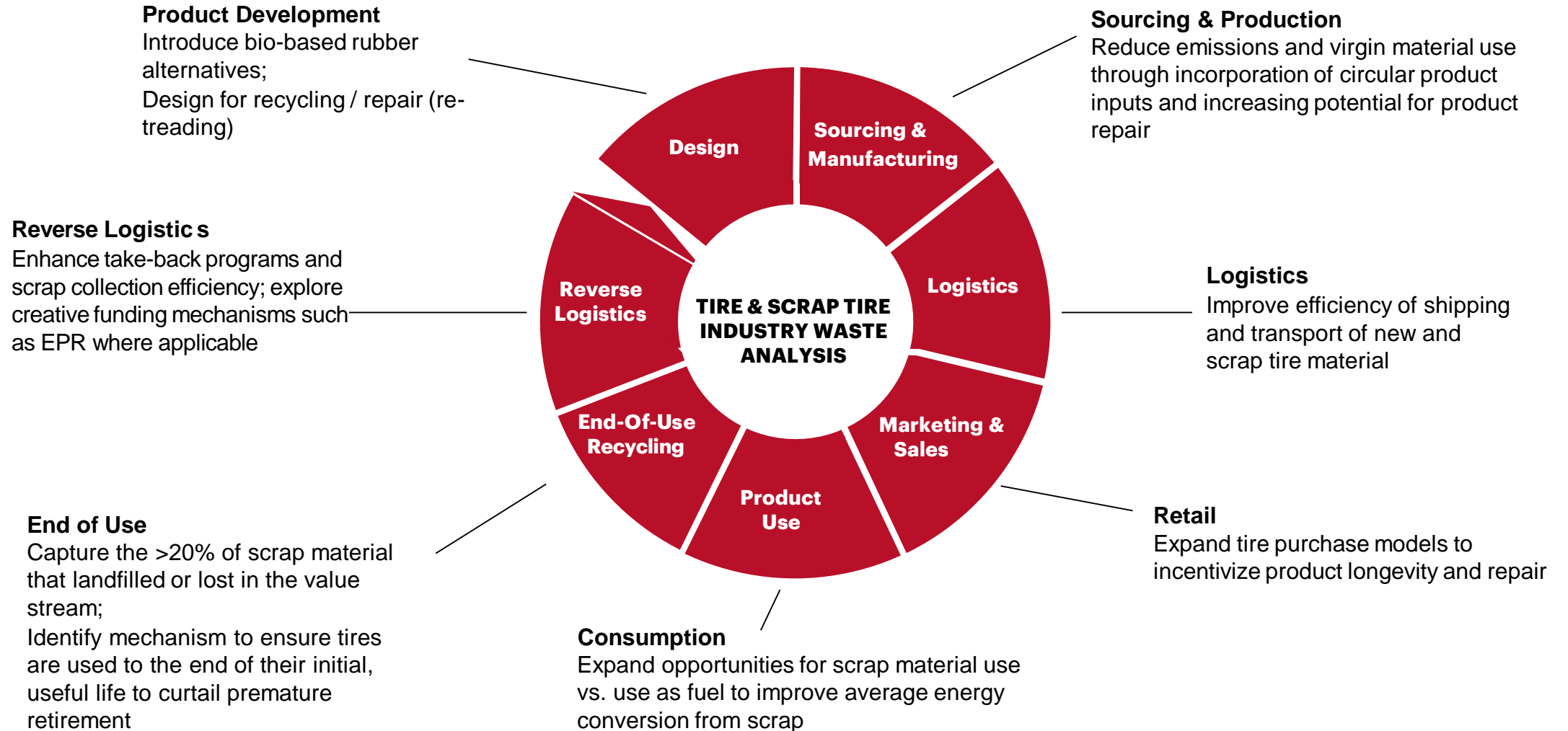
Opportunity for Increased Use & Circularity

- In the last three years, total **scrap production has increased 4%**, while **recycling and recovery has declined ~7%**
- As production continues to increase, this **opportunity gap is projected to increase**
- **~900,000 tons of generated scrap never reached the scrap tire market in 2017 (22%)**
- **Only ~36% of scrap material is retained within material streams** through manufacturing (e.g., ground rubber, crumb, etc.) civil engineering, and reclamation projects

Source: USTMA; Approximate use by type based on *U.S. Scrap Tire Management Summary, 2017*

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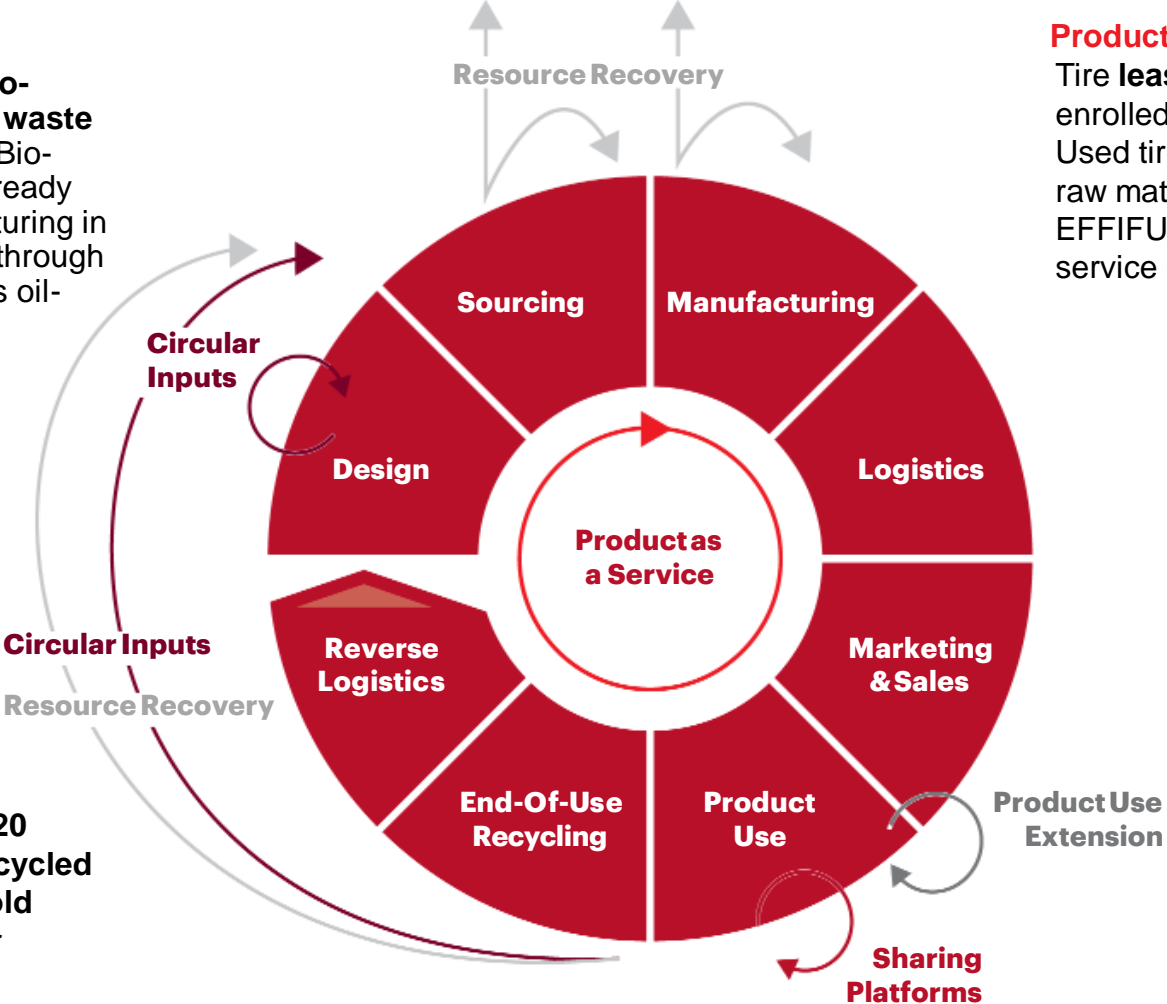
SCRAP TIRE INDUSTRY HAS AN OPPORTUNITY INNOVATE ACROSS THE VALUE CHAIN TO REDUCE WASTE



LEADING TIRE INDUSTRY PLAYERS ARE ALREADY CAPITALIZING ON THE VALUE OF CIRCULARITY

gevo **Circular Inputs**

Gevo Inc. is making **bio-based isoprene from waste biomass, feedstock**. Bio-based isoprene has already been used in manufacturing in tires and is recyclable through the same processes as oil-based isoprene



Product as a Service



Tire leasing program; ~400,000 vehicles enrolled
Used tires are **100% recovered** as secondary raw material or alternative energy
EFFIFUEL and EFFITIRES fuel efficiency service unlocks **savings for customers**



Product Use Extension
Continental developed the first **integrated retreading and recycling facility** – extend tire life through retreading and use tire tread buffings from the retreading facility as inputs for retreading and new tires
Reduces waste by 80% and lowers their costs, for the 180,000 tire annual capacity



Resource Recovery
AkzoNobel is one of **20 customers** using **upcycled carbon black from old tires** to make powder coatings

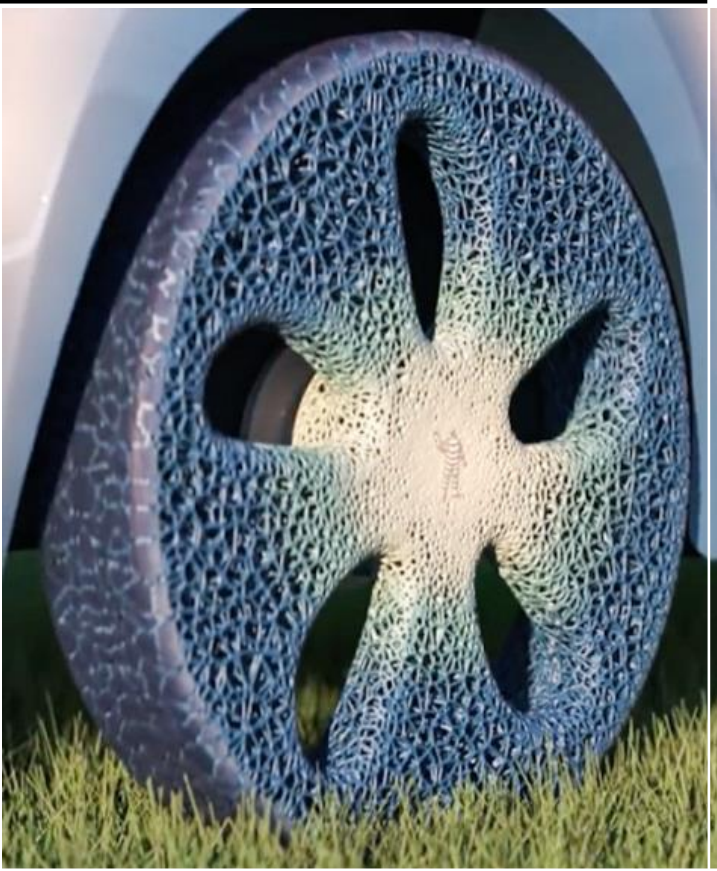
Sharing Platforms



Tata Steel and Steel Authority of India developed a JV **e-marketplace for secondary steel**; consolidating 30 waste streams

INNOVATION IS UNLOCKING **NEW OPPORTUNITIES FOR TIRE CIRCULARITY**

PRODUCT INNOVATION



CONSUMPTION INNOVATION



PROCESS INNOVATION



Sources: Michelin Automotive Tires, Goodyear Tire and Rubber Company, Lehigh Technologies
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MANUFACTURERS AND STARTUPS PIONEERING CIRCULAR ECONOMY

ILLUSTRATIVE / NON-EXHAUSTIVE

PRODUCT INNOVATIONS

Biogenic / Recycled Materials



Fuel Economy (airless, less rolling resistance, lighter)



Designed for Recyclability



Long-lasting / Self-Repairing



CONSUMPTION INNOVATION

Repair / Retreading



Smart / Connected Tires



CO₂ Capture, Biodegradable



New End-of-life Markets



PROCESS INNOVATION

Reclaim / Reprocess (MRP)



3D Printed



Bio-sourced Isoprene

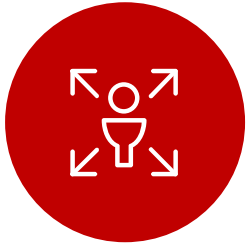


Closed Loop Operations



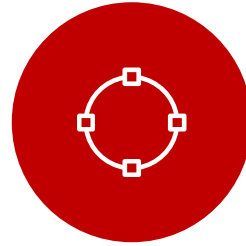
Sources: Michelin Automotive Tires, Goodyear Tire and Rubber Company, Lehigh Technologies, Nokian Tyres, Bridgestone, Indosole, Firestone, Timberland, ENSO
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CALL TO ACTION



Set a Circular Vision

Leadership can create the business imperatives, cultural changes, and governance to promote the circular mindset, objectives, and integrated goals/metrics.



Understand the Economics

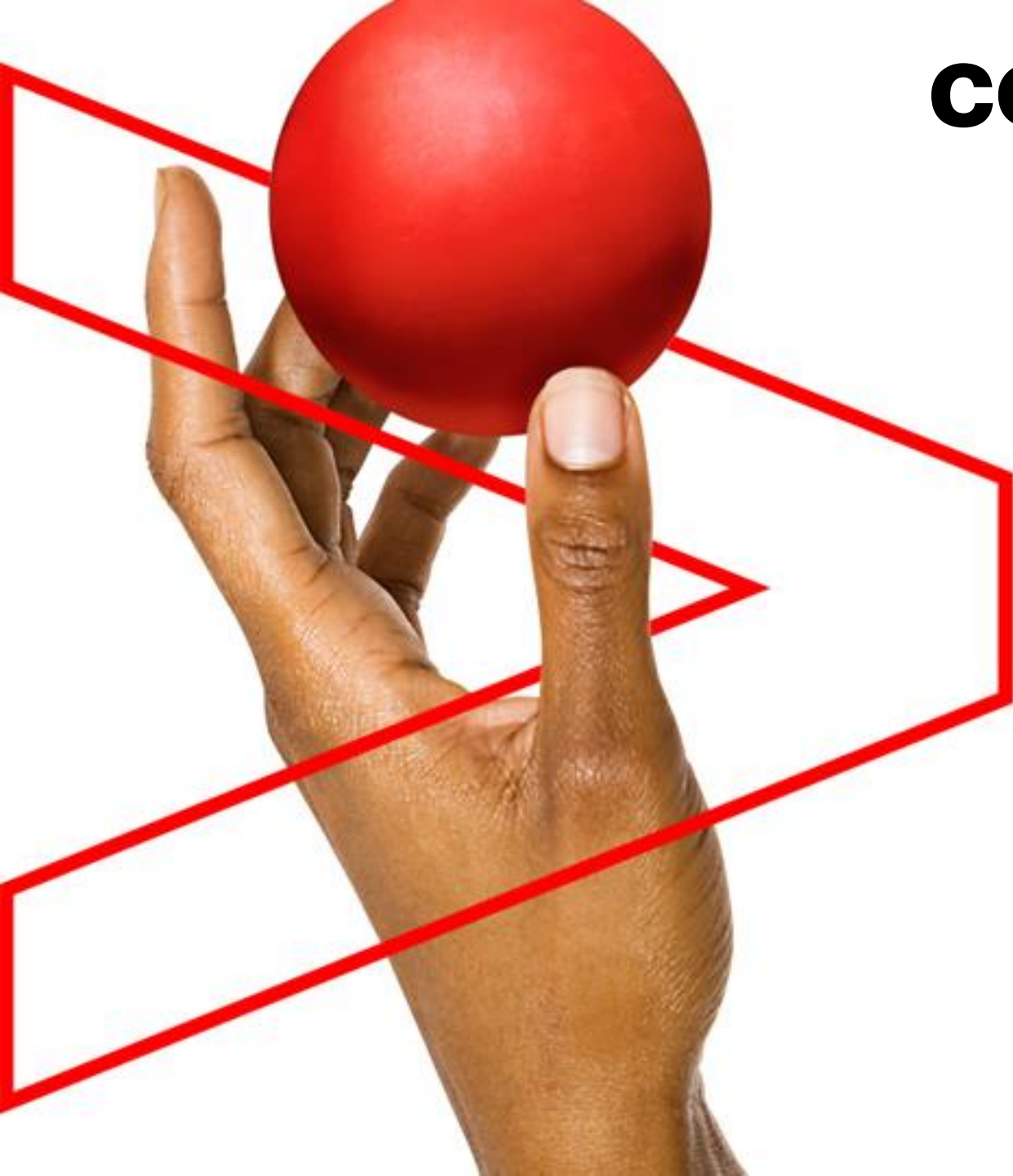
Move beyond waste and recycling to leverage the full suite of circular business models, and capture all scrap material generated in the market



Pre-Competitive Collaboration

Join forces across value chains - engage with other tire manufacturers, scrap recyclers, and consumers. Work to scale solutions to move the whole industry forward while reducing impact.

CONTACT OUR TEAM



Pasha Ponomarev | Principal Director
Accenture Sustainability Strategy
San Francisco, CA
pavel.ponomarev@accenture.com



Caroline Larose | Manager
Accenture Sustainability Strategy
New York, NY
caroline.larose@accenture.com