Gabelli Funds
191 Mason Street
Greenwich, CT 06830
Tel (914) 921-5100
www.gabelli.com

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Life Cycle of a Tire: Global Picture

Rebecca Stern, PhD
(914) 921-7717

Rosemarie Morbelli
(914) 921-7757

Carolina Jolly
(914) 921-7762

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Summary
The global tire industry, valued in the hundreds of billions, intersects with critical sustainability, policy, and industrial supply chain themes. This white paper explores the entire tire lifecycle: from raw material sourcing to disposal—and identifies where companies in waste management, commodities, and specialty chemicals are poised to benefit. U.S. tariff policy and tightening global environmental regulations are driving reshoring, innovation, and margin shifts across sectors.

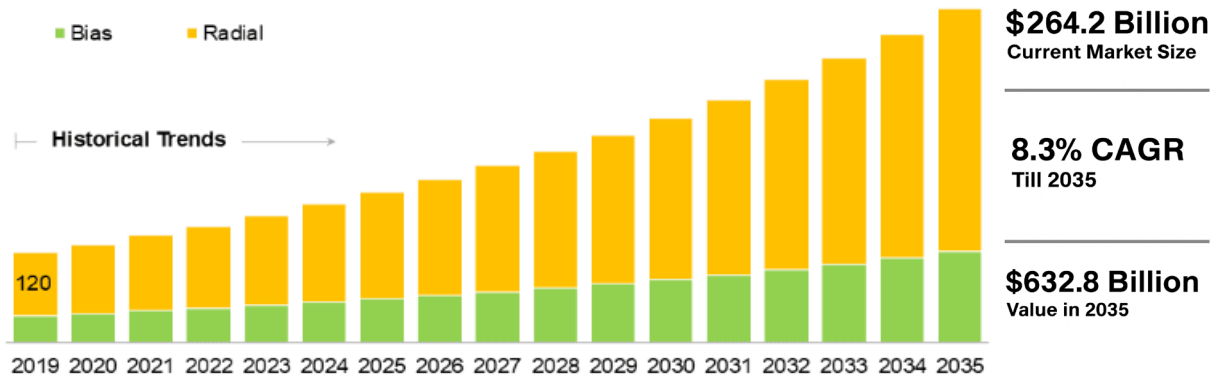
Overview
Tires present a critical component supporting automotive, logistics, aviation, and other industries. Approximately 2 billion tires are produced every year to meet the needs of passenger vehicles, commercial trucks, motorcycles, and other vehicles. Leading tire manufacturers like Michelin, Bridgestone, Goodyear, Continental, and Pirelli account for a significant portion of global production. Trends such as EV adoption, smart tires, and bio-based inputs are reshaping the product landscape.

With the rise in sustainability focus and the environmental concerns surrounding tire pollution, companies have recently explored greater use of recycled materials, bio-based alternatives, and improved recycling technologies. Electric Vehicle (EV)-specific tires are now in greater demand, with specialized designs for lower noise, higher durability for torque-heavy EVs, and low rolling resistance. Technological advances in robotics and AI have contributed to improvements in manufacturing efficiency. Smart tires are trending, with embedded sensors tracking wear, pressure, and performance. Sustainable design and production continue to be a focus of many governments and consequently the companies operating within their region.

Companies involved in waste management with exposure to tire recovery may benefit from anticipated stricter regulations on tire disposal and recycling. Commodity and specialty chemical companies may benefit from rising tire demand. Cabot Corp (NYSE: CBT) and Orion SA (NYSE: OEC) supply carbon black, and Kumho Petrochemical (KRX: 011780) manufactures synthetic rubber for tires. Tariffs and trade policies may influence tire demand and production. U.S. tariffs on imported tires have benefited domestic manufacturers like Goodyear by reducing competition from imports.

The global tire industry is experiencing growth driven by several key factors and leading to a projected CAGR of 8.3% between 2024 and 2035 (Exhibit 1). Expansion of automotive tires is a result of increasing production and sale of vehicles, especially in emerging economies, as well as technological advancements related to smart tires, sustainability initiatives driving innovation, and rising urbanization that contributes to increased vehicle ownership.

Exhibit 1 Automotive Tire Market ($ Billion) by Tire Type

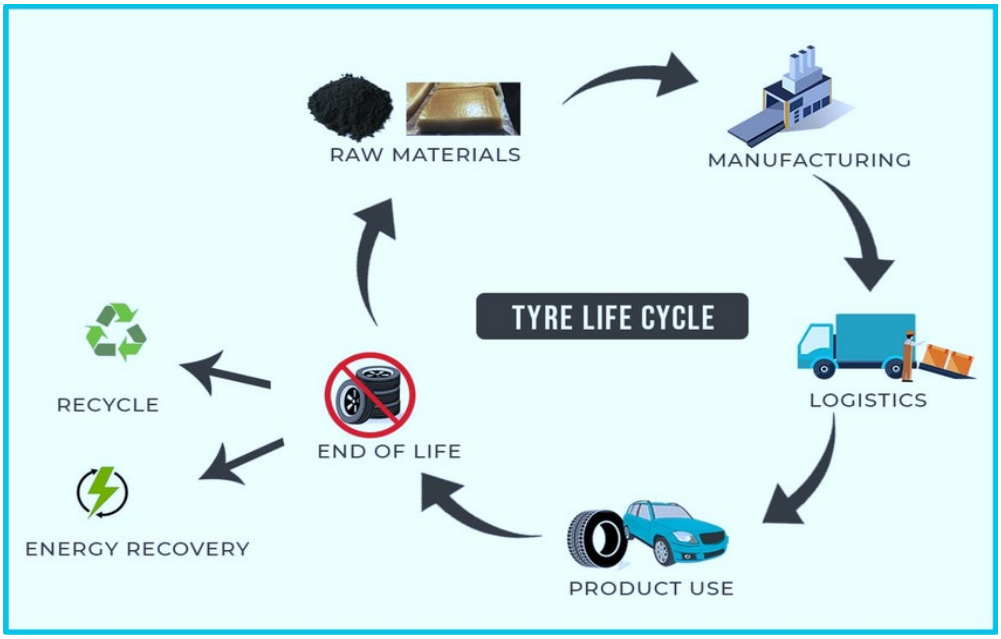


Source: https://www.rootsanalysis.com/automotive-tire-market

Sustainability and Environmental Impact

Tire manufacturing and disposal pose environmental concerns at nearly every stage of their lifecycle, from production to disposal. At the manufacturing stage, deforestation associated with natural rubber harvesting causes biodiversity loss, particularly in Southeast Asia. Synthetic rubber derived from petroleum contributes to carbon emissions and other air pollution in chemical manufacturing. Microplastic pollution from tire wear continues to develop as a concern. Upon end of life, the disposal of these tires is achieved through recycling, incineration, energy production, or landfills. Incineration releases large amounts of pollutants including particulate matter, sulfur oxides, nitrogen oxides, heavy metals, dioxins, furans, and other greenhouse gases. Disposal of the toxic ash following incineration is a challenge and requires special handling. Positive trends in the environmental space are shifting toward sustainable techniques including use of recycled rubber, bio-based materials, and energy efficiency.

Exhibit 2 **The Life Cycle of a Tire**

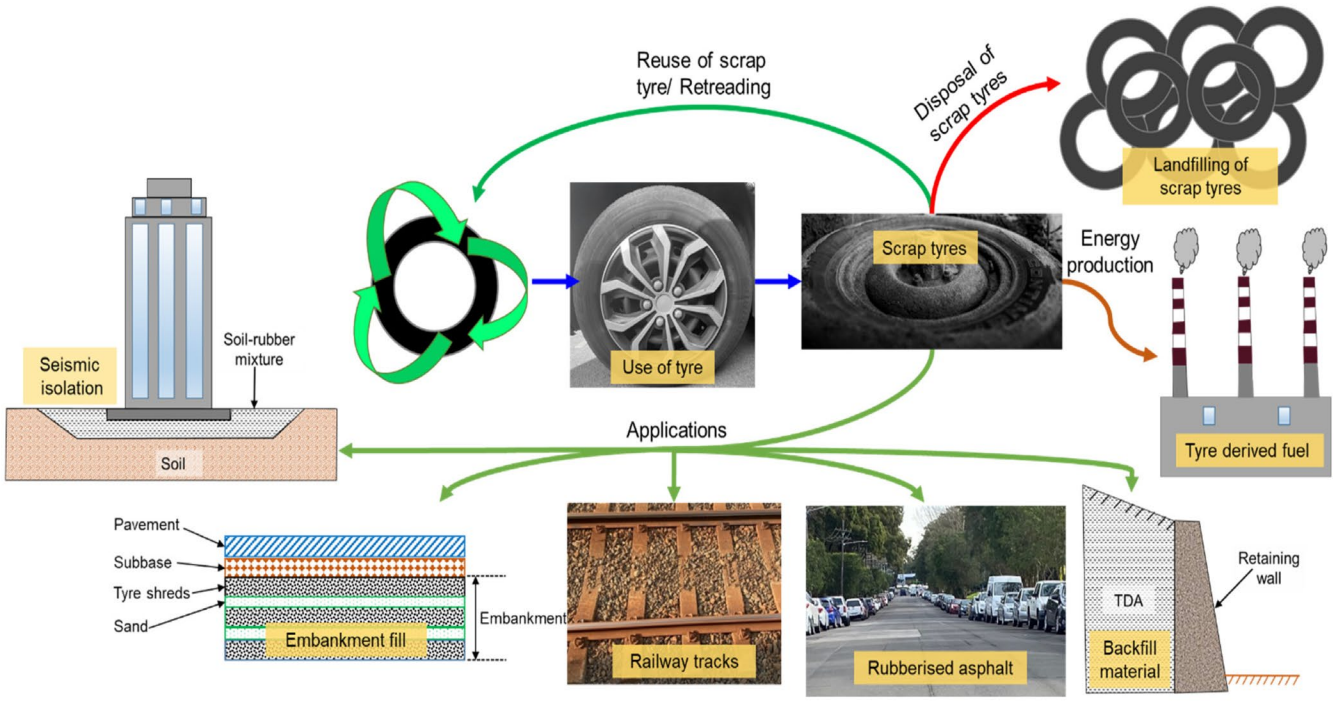


Source: Research Gate

Tires are produced from natural rubber (harvested from rubber trees) and synthetic rubber (derived from petrochemicals, primarily crude oil) (Exhibit 2). Additives including steel, textiles, carbon black, silica, and other chemicals are used in the manufacturing process as well. Composition varies by tire but is approximately 41% rubber (synthetic and/or natural), 14% steel, 28% carbon black, and 16% fabric, fillers, antioxidants, and antiozonants. In manufacturing, the tire ingredients are mixed, shaped, and cured in a mold under heat and pressure to vulcanize the rubber. Once on a vehicle, tires wear down from normal friction and road conditions. Tires need maintenance via pressure checks, rotation, tread inspection, and wheel alignment, which can extend their life. Some tires, especially on trucks, even undergo retreading to delay replacement.

At the end of life, tires can be recycled or disposed of (Exhibit 3). In recycling, they are ground into rubber for use in playgrounds, athletic tracks, and road construction. They can also be incinerated – used as fuel in cement kilns or power plants. Alternatives to incineration, aside from the aforementioned mechanical recycling, include pyrolysis (heating tires without oxygen to produce oil, gas, and carbon black) and devulcanization (reclaiming rubber for new tires or other industrial uses). Tire-derived fuel (TDF) is a processed fuel made from shredded scrap tires and used as a substitute for fossil fuels in cement kilns, paper mills, utility boilers, and industrial furnaces. TDF offers an advantage over other fuels like coal due to its high heating value (13,000-16,000 BTUs/lb). It can be co-fired with biomass or coal and the resultant ash may be captured for various end-uses, including cement manufacturing. Fuel harvesting from burning tires differs from the traditional incineration methods of disposal, which did not involve energy recovery and often did not meet emission control requirements to reduce harmful pollutants like dioxins, PAHs, VOCs, and heavy metals. Finally, in some countries, tires may be disposed of in landfills, the extent to which is regulated by many countries.

Exhibit 3 **Waste Tire Processing**



Source: MDPI

Regional Markets
Leading tire manufacturers are based in many different countries, including Japan (Bridgestone), France (Michelin), the U.S. (Goodyear), Germany (Continental), and Italy (Pierelli).

Asias
The Asia-Pacific (APAC) tire market is a major contributor to the global tire industry, which is projected to exceed $630 billion by 2035. Rapid vehicle production, rising middle-class ownership, and regional manufacturing strength are fueling growth.

- **Regional Growth Drivers**
  - Asia's rising vehicle production and sales are accelerating tire demand both regionally and globally.
  - Growth is tied to expanding middle-class populations and urbanization.
  - Increased focus on retreaded tires, Original Equipment Manufacturer (OEM) demand, and Radial tires in commercial trucks
- **Key Country Highlights**
  - China is the largest global producer and consumer of tires, and it supplies both domestic and international markets.
  - India has a rapidly growing tire market, with strong pricing and expansion in radial tire production for trucks and buses. Apollo Tyres Ltd (NSE: APOLLOTYRE) offers the Vredestein brand in Europe. CEAT Ltd. (NSE: CEATLTD) leads in 2-wheeler and commercial tire production, with growing export momentum.
  - Japan is home to Bridgestone Corporation (TYO: 5108.T), the world's largest tire manufacturer. The country's strengths include premium brands (Potenza, Turanza), strong R&D, and OEM relationships. It also has diversified into industrial rubber, bicycles, and other sectors

- South Korea is headquarters for Hankook Tire & Technology (KOSDAQ: 161390.KQ), which is rapidly expanding in OEM and replacement segments. The country is known for its smart tires, EV-specific designs, and affordability.

Europe

The European tire market is approximately $45 billion with 5 billion tires produced annually. It is shaped by stringent environmental regulations, a strong commitment to the circular economy, and mandatory EU tire labeling, especially in the replacement tire segment. These policies have led to increased use of recycled materials and a focus on low-emission, fuel-efficient, and winter-rated tires.

- Premium tires enjoy high market penetration across Europe, with electric vehicle (EV) tire innovation emerging as a key growth driver. Michelin (XPAR: ML), headquartered in Clermont-Ferrand, France, is a global leader in high-performance tires and sustainability initiatives. The company has a long-standing presence in motorsports (Formula E, Le Mans) and is advancing next-generation solutions such as the airless Michelin Uptis.
- Germany's Continental AG (FRA: CON) dominates the winter and all-season tire markets and is known for its integration with original equipment manufacturers (OEMs) in advanced driver-assistance systems (ADAS) and electric vehicles. The company also plays a significant role in autonomous vehicle components, including sensors and braking systems.
- Pirelli & C. S.p.A. (BIT: PIRC), based in Italy, specializes in luxury and high-performance tires and maintains partnerships with brands like Ferrari and Lamborghini. Its exposure to Formula 1 racing and investment in EV and sustainability R&D further reinforces its premium positioning.
- Finally, Nokian Tyres (HEL: TYRES), headquartered in Finland, leads in extreme weather tire innovation. The company is widely recognized for its emphasis on safety, low rolling resistance, and environmentally responsible production processes.

North America

The North American tire market benefits from robust demand for high-performance products, including light truck, SUV, all-season, and winter tires. EV adoption has accelerated demand for tires with high durability, low rolling resistance, and reduced noise—especially for urban and highway use. Smart tire technology is also gaining traction, as consumers and fleet operators seek real-time monitoring and performance optimization.

- The U.S. produces approximately 325–350 million tires annually, with a market size estimated at around $45–50 billion, driven largely by replacement tires and commercial vehicle fleets.
- Headquartered in Akron, Ohio, Goodyear Tire & Rubber Company (NASDAQ: GT) is one of the oldest and most recognizable American tire brands. The company recently acquired Cooper Tire to expand its U.S. market share and broaden its product offerings. Goodyear has increased its investment in smart tire technologies and maintains a strong position in the domestic replacement tire market and commercial fleet segment.
- Another key player is Titan International (NYSE: TWI), based in Quincy, Illinois. Titan specializes in off-the-road (OTR) tires for agriculture, construction, and earthmoving equipment, with a particular strength in OEM tires for tractors and combines.

Latin America and Middle East & Africa

The tire market in Latin America is recovering as vehicle demand rebounds, particularly in Brazil, Mexico, and Argentina. Growth is being driven by increased economic activity and rising vehicle ownership. The region sees widespread use of imported tires, retreaded products, and budget brands, making price sensitivity a key market factor. Most major tire manufacturers operating in the region are privately held, such as FATE, a well-established company based in Argentina.

In the Middle East and Africa (MEA), market growth is fueled by rising focus on product quality, regulatory compliance, and infrastructure development, which in turn drives demand for off-road and commercial vehicle tires. Due to economic constraints and limited local manufacturing, affordable options such as used and retreaded tires remain dominant in many MEA markets. Africa remains largely underserved, presenting strong growth potential for commercial and utility-grade tire segments. Most tires sold in the MEA region are imported, often from Asia and Europe.

Waste Management as Beneficiary

Tire waste is managed differently around the world. Stricter disposal rules and carbon neutrality goals are increasing demand for advanced recovery systems for tires. Waste firms benefit from: expansion of tire pyrolysis and devulcanization infrastructure; growth in rubber-modified asphalt and recycled construction materials; and high-BRTU tire-derived fuels for cement kilns and paper mills. Countries like Germany and Japan lead in recovery efficiency; the U.S. is expanding incineration-for-energy infrastructure. Finally, waste handlers with sustainability-forward practices and circular capabilities may see advantages in the longer term.

According to the U.S. Tire Manufacturers Association, roughly 300 million and 350 million tires are scrapped annually in the U.S. and the EU, respectively. In Europe, the EU Waste Framework Directive bans landfilling of tires. Instead, approximately 140 million tires in the EU are recycled into crumb rubber, and around 175 million tires are used in energy recovery via cement kilns and TDF (tire-derived fuel). Pyrolysis and devulcanization are also gaining traction. Germany, Sweden, and the Netherlands are known for exceptionally high recycling rates and low emissions. In the U.S., of the estimated 300 million scrap tires generated annually, about 240 million are recovered. Of those, approximately 96 million tires are used for TDF, 75 million are used for ground rubber, 21 million go into civil engineering applications, and around 60 million end up in landfills or stockpiles.

Japan emphasizes both material recycling and energy recovery, with bans on landfills similar to those in Europe. South Korea has a highly efficient tire collection; they are increasingly used for pyrolysis and rubber modified asphalt. China has historically had high rates of landfilling and uncontrolled incineration, with enforcement still inconsistent in rural areas. India is a large importer of waste tires, often used for pyrolysis; the emission control on these systems is poorly regulated in the country, although recent governmental efforts have been directed at addressing polluting operations. Finally, Brazil requires manufacturers to take back the old tires and bans landfills. The country encourages collaboration between tire manufacturers and the cement industry for both, co-processing and using recycled rubber in civil construction.

U.S. Tariffs and Industrial Policy

The US Department of Commerce imposed tariffs on tires imported from China in 2015. These antidumping duties ranged from 15% to 88% to counteract the flood of cheap Chinese-imported tires that pressure market prices in the US. While these tariffs supported some price increases for domestic manufacturers in the near-t erm, cheaper tire product simply moved to other low-cost countries – specifically Thailand, Vietnam and Indonesia (Exhibit 4). Under the new administration potential reciprocal tariffs may be imposed on products from these countries; however, the final decision remains uncertain at this point. Tariffs +30% were announced in April; however, later delayed for 90 days. While uncertain, we do believe that broad-based tariffs, combined with sustainability disclosure mandates and infrastructure investment, create a favorable regulatory tailwind for select U.S.-based players such as Goodyear Tire (GT) and down the supply chain, Monro Inc (MNRO).

Table 1 US Passenger Tire Imports - Origin

(in millions of units, rounded)

COUNTRY	2024	2023	% CHANGE
Thailand	42.0	36.3	15.7
Mexico	22.9	22.7	0.6
Vietnam	15.0	13.3	12.8
Indonesia	13.4	13.9	-3.5
Canada	10.2	10.0	1.2
South Korea	8.9	11.9	-25.7
Cambodia	8.8	5.3	64.6
Japan	8.7	9.0	-3.1
Chile	4.9	5.2	-7.0
Malaysia	3.6	4.0	-10.6

Source: Modern Tire Dealer (MTD) 2024 Facts Issue

Future Directions: AI, EV, and Specialty Chemical Tailwinds

Tire innovation is generating new demand across the supply chain. The following sectors are leveraged to both volume growth and premiumization trends, as tire manufacturers continue to compete with respect to performance, sustainability, efficiency, and durability. Electric Vehicle (EV)-specific tires are now in greater demand, with specialized designs for lower noise, higher durability for torque-heavy EVs, and low rolling resistance. Technological advances in robotics and AI have contributed to improvements in manufacturing efficiency. Smart tires are trending, with embedded sensors tracking wear, pressure, and performance. Sustainable design and production continue to be a focus of many governments and consequently the companies operating within their region. Companies involved in waste management with exposure to tire recovery may benefit from anticipated stricter regulations on tire disposal and recycling. Commodity and specialty chemical companies may benefit from rising tire demand. Cabot Corp (NYSE: CBT) and Orion SA (NYSE: OEC) supply carbon black and Kumho Petrochemical (KRX: 011780) manufactures synthetic rubber for tires. Tariffs and trade policies may influence tire demand and production. U.S. tariffs on imported tires have benefited domestic manufacturers like Goodyear by reducing competition from imports.

Conclusion

The tire industry is undergoing transformation driven by electrification, sustainability mandates, and protectionist trade policy. These shifts have led to notable investable themes including sustainability, which is moving from reputation to regulatory imperative and benefiting circular economy players. Waste management firms are seeing rising demand from tire recovery and valorization capabilities. Commodity and specialty chemical suppliers that are particularly linked to smart, sustainable tire inputs stand to gain share. The potential for broad based tariffs on lower cost countries offer future opportunities to promote domestic manufacturing and raise prices. Higher prices would support improved manufacturing margins for domestic tire manufacturers such as GoodYear Tire (GT).These higher prices should support the entire supply chain, enhancing the end-market independent repair chain's ability to increase price during higher cost times and driving margins. Developing markets in Asia-Pacific and Latin America continue to drive volume growth. Overall, we see growing demand from passenger vehicles, commercial fleets, and off-the-road applications. Dominated by major players like Bridgestone, Michelin, Goodyear, and Continental, the industry is characterized by high capital intensity, strong brand loyalty, and regional manufacturing hubs across Asia, North America, and Europe. Areas to continue observation include rising raw material costs, environmental concerns around end-of-life tire disposal, and competition from low-cost producers.

Rebecca Stern, PhD
(914) 921-7717

Rosemarie Morbelli
(914) 921-7757

Carolina Jolly
(914) 921-7762

191 Mason Street, Greenwich, CT 06830 Gabelli Funds TEL (914) 921-5100

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