# MODERN APPROACHES TO CIRCULAR INSURANCE

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***Abstract:*** *The objective global need for the continuous development of the circular economy requires the promotion of essential elements of contribution, which are inclusively linked to the implementation of related insurance products united in a general notion of circular insurance. This involves applying circular economy principles to risk management and the insurance sector. This approach transitions from a linear model of "take-make-throw" or "pay-repair-replace" to one emphasizing repair, reuse, refurbishment, and waste reduction. The focus shifts from merely compensating for losses to actively preventing them and maintaining asset value. The research on the topic was based on examining information from open sources published on the Internet. The purpose of the paper was to present the conceptual aspects of circular insurance. Creating circular insurance requires transforming the sector from a traditional "take-make-dispose" approach to one that prioritizes resource efficiency, minimization of waste, and the ongoing utilization of materials. Essential strategies encompass promoting repair rather than replacement, providing products based on usage. These activities can be related to promoting new business models like sharing and Product-as-a-Service (PaaS), and facilitating the reuse of materials. Supporting the circular economy through insurance requires the development and implementation of new insurance products. In this context, leveraging technology and data becomes of great importance. At the same time, the development of circular insurance is linked to overcoming a wide range of challenges.*

***Keywords:*** *circularity; insurance; product; technology; challenge*

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# 1. Introduction

To transition from a "take-make-waste" linear model to a sustainable system that replenishes natural systems, lowers emissions, and separates economic growth from resource consumption, a circular economy must be developed. According to the Circularity Gap Report 2025 (CGR), the global economy is only 6.9% circular, a decline from 7.2% in 2023 and 9.1% in 2018. It means that over 90% of the more than 100 million tons of extraneous material produced each year are either recycled or not reused. (Reconomy).

This transition addresses environmental crises like climate change and pollution, while offering $4,5 trillion in economic opportunities and fostering resilience, innovation, and job creation. (UNEP, 2021).

The following can be highlighted as the main factors and needs of the circular economy:

- The main argument is environmental protection, as the linear model causes significant pollution, waste and resource scarcity, threatening biodiversity and causing climate change.
- Second, resource scarcity and stability are manifested. As demand for resources increases, the circular model keeps materials in use through repair, reuse, and recycling, reducing dependence on imports and strengthening supply chains.

- The third argument is related to economic opportunity, stemming from the fact that moving to a circular model can create millions of jobs in sectors such as recycling, repair and remanufacturing.
- Fourthly, cost savings for private consumers and businesses driven by the creation of more durable products and the focus on repairs and renovations can be mentioned.
- Fifth, it is about the expectation of climate change mitigation, as waste reduction and material reuse contribute to significantly reducing greenhouse gas emissions.

Circular insurance, in the realm of the "circular economy," pertains to risk transfer solutions developed to enhance sustainability by emphasizing the repair, reuse, refurbishment, and recycling of materials instead of disposal.

Circular insurance involves implementing circular economy principles within the risk management and insurance sector, shifting from a linear "take-make-dispose" (or "pay-repair-replace") approach to one that emphasizes repair, reuse, refurbishment, and minimizing waste.

Circular insurance constitutes a revolutionary method that connects the insurance sector with the tenets of the circular economy - repair, reuse, and recycling - moving away from the conventional "take-make-dispose" paradigm. This model seeks to minimize waste, decrease carbon emissions, and prolong the lifespan of insured assets, especially in automobile and electronics insurance.

Circular insurance is frequently included in larger "sustainable," "ESG-focused," or "circular economy" insurance categories and represents a fast-growing sector that emphasizes underwriting risks associated with recycling, reuse, repair, and renewable technologies. The purpose of this article is to examine the basic aspects of circular insurance as a contributory element to the development of the circular economy.

# 2. Literature Review

The literature related to traffic insurance is relatively diverse, with the majority of bibliographic sources being the views of experts in the field. These sources can be conventionally divided into certain groups. Some authors examine the essence of circular insurance. (Neumann, 2025), (Meegle, 2026) Other experts have researched insurance as a factor supporting the circular economy. (Avantaventures, 2023), (Insurance), (Insurancetimes, 2024), (Neumann, 2025), (Steadfast, 2022) Works related to circular insurance products can be presented separately. (ABN AMRO, 2021), (Meegle, 2026), (Neumann, 2025), (Joey Galloway, 2023), (Steadfast, 2022) Likewise, research related to technologies used in circular insurance is worth mentioning. (Awasthy et al., 2025), (Revivack, 2024), (Alex Pezold, 2025), (V7Labs, 2025) Certain authors draw increased attention to the challenges for developing circular insurance. (Evolveable Consulting, 2024), (Hersch et al., 2024), (INGKA, 2023), (Kirchherr et al., 2018), (Mukhopadhyay, 2023), (Swiss Re, 2023).

# 3. Methodology

In order to carry out the research, the screening open information sources was applied as a research methodology is a systematic, transparent, and structured process of identifying, evaluating, and selecting relevant data from publicly available sources to answer specific research questions.

# 4. Results and Discussion

By switching from "replace-first" to "repair-first" models, cutting waste, and supporting new circular business models like sharing platforms and remanufacturing, circular insurance is essential to the circular economy. By controlling the risks associated with renewable energy, promoting repairs in claims, reducing emissions, generating new revenue sources, and enhancing resilience, it makes sustainability possible. (Neumann, 2025), (Meegle, 2026).

The role of insurance in supporting the circular economy can be expressed as follows (Avantaventures, 2023), (Insurance), (Insurancetimes, 2024), (Neumann, 2025), (Steadfast, 2022):

- *Sustainable Claims Management:* Insurers are updating policies to prioritize repair, refurbishment, and recycling over replacing items. This reduces carbon footprints in the claims process—often an insurer's largest environmental impact.
- *Enabling Circular Business Models:* Insurance supports the sharing economy (e.g., Uber, BlaBlaCar), product-as-a-service models, and repair businesses by identifying and mitigating new risks associated with these models.
- *Encouraging Resource Efficiency:* By promoting the repair and reuse of materials, insurers reduce reliance on virgin materials, aligning with the core circular goal of keeping products in use.
- *Risk Management for Green Technologies:* Insurers are increasing their portfolios to include renewable energy and green projects, with specialized underwriting for new risks, such as those in EV manufacturing.
- *Resilience Against Disruptions:* Circular practices (repairing rather than replacing) allow businesses to be less vulnerable to supply chain issues and volatile material costs.

Contributing to the development of the circular economy can have certain benefits for the insurance industry:

- *Reduced Costs:* Repairing instead of replacing can reduce the average cost of claims, improving long-term profitability.
- *Reputation Management:* Engaging in circularity helps carriers meet consumer demand for sustainability and enhances their reputation, protecting them from criticisms related to insuring high-carbon industries.
- *Innovation and New Markets:* The transition allows insurers to develop new insurance products designed for circular supply chains.

- *Customer Loyalty:* Circular insurance boosts customer loyalty by integrating sustainability (repair, reuse, recycling) into claims and service, aligning with eco-conscious consumer values to build trust.
- *Regulatory Compliance:* It meets emerging EU requirements, such as the Circular Economy Action Plan, which prioritizes resource efficiency.

An important aspect of developing circular insurance is innovating product offerings:

- ***Product-as-a-Service (PaaS) Coverage:*** Product as a Service (PaaS), also known as a Product-Service System (PSS), is a business model within the circular economy that prioritizes selling a service or functional capability of a product instead of the product itself. In numerous PaaS frameworks, companies maintain ownership of the physical asset and rent it out to clients who pay a subscription fee based on time or usage. (Robeco) Circular insurance for Product-as-a-Service (PaaS) models shifts risk from ownership to usage, protecting providers rather than consumers. Policies often cover maintenance and repairs, incentivizing high-quality, durable products. Insurance protects the provider who retains ownership of the asset, covering potential damage or loss during the customer's usage. It covers maintenance, repair, and refurbishment costs to extend product life, ensuring sustainability. Insurance ensures that after the subscription, the product can be safely returned, refurbished, or repurposed rather than discarded. This model requires insurance that covers asset return, re-manufacturing, and performance-based liability, covering the entire lifecycle rather than a single sale (ABN AMRO, 2021).
- ***Repair and Reuse Focus in Claims:*** Redesigning policies to incentivize repairing insured assets (e.g., vehicles, electronics) instead of automatic replacement, reducing waste and lowering claims costs.
- ***Sustainability-Linked Policies:*** Policies are increasingly designed to prioritize repairing insured assets (e.g., vehicles, building materials) over replacing them with new ones, which significantly lowers carbon emissions and waste. Offering premium discounts or coverage benefits for policyholders adopting eco-friendly behaviors or utilizing refurbished components. Policyholders may receive lower premiums or better coverage terms for opting to use certified repair networks or recycled parts. (Meegle, 2026), (Neumann, 2025)
- ***Usage-Based Insurance (UBI):*** UBI often referred to as telematics or pay-as-you-drive (PAYD) insurance, is a modern auto insurance model that determines premiums based on actual vehicle usage—including distance, driving behavior, and time of day—rather than traditional static factors like age, gender, or credit history. By leveraging technology such as telematics devices, Bluetooth beacons, or mobile apps, UBI offers a more personalized and transparent pricing structure that can reward safe and low-mileage drivers with lower premiums. Use IoT devices to calculate premiums based on actual usage, encouraging shared ownership models like car-sharing. (Indusindinsurance)
- ***Warranty for Refurbished Goods:*** Refurbished goods are increasingly supported by robust warranty and insurance structures, often designed to facilitate the circular economy by extending product lifecycles and encouraging repair over disposal. These guarantees are distinct from new product warranties, typically featuring shorter durations or specific coverage tailored to certified reconditioning standards.

- ***Take-back Scheme Insurance:*** Protects manufacturers or retailers that take back products for recycling or refurbishment, covering risks associated with the return logistics and secondary material value. Take-back schemes are a core component of the circular economy where manufacturers or retailers take back products at the end of their first life cycle to refurbish or recycle them. These schemes introduce new risks, such as liability during transport, storage, and refurbishment, which require specialized insurance coverage. (Joey Galloway, 2023), (Steadfast, 2022)
- ***Shared Asset Coverage:*** Developing specialized insurance for collaborative consumption models, such as car-sharing or peer-to-peer platforms. Shared asset coverage within a circular insurance context typically refers to insurance models supporting the circular economy, where assets (like vehicles, tools, or machinery) are shared, rented, or reused rather than owned individually. These policies often use microinsurance to cover risks for the duration of a transaction, such as a rental or delivery period.

Offering circular insurance products requires leveraging technology and data. First of all, it's about ***IoT & Telematics***.

Real-time monitoring of assets to enable preventive maintenance and increase lifespan. Use sensors to monitor assets in real-time, enabling preventive maintenance that extends their lifespan and reduces claims. IoT and telematics are rapidly transforming the insurance industry, shifting it from a reactive "repair and replace" model to a proactive, "predict and prevent" approach. This evolution is key to circular insurance, which aims to reduce waste, extend the life of assets, and promote sustainability through real-time risk management. (One Inc, 2022), (One Inc, 2024), (Sharma, 2025)

Key Applications of IoT & Telematics in Circular Insurance (Com4, 2025), (Koppanati, 2024), (One Inc, 2022), (One Inc, 2024), (Sharma, 2025):

- *Usage-Based Insurance (UBI):* Telematics devices and smartphone apps collect real-time data on driving behavior (braking, speed, mileage) to personalize premiums, rewarding safe, low-mileage drivers.
- *Predictive Asset Maintenance:* Sensors on commercial equipment and vehicles monitor health in real time, detecting issues before they fail. This prevents major claims and extends the lifespan of the machinery.
- *Property Protection & "Connect and Protect":* IoT sensors detect water leaks, smoke, or electrical hazards, triggering immediate alerts to prevent damage. For instance, smart plugs monitor electrical wiring for potential fire hazards, allowing for intervention before a fire occurs.
- *Claims Management & Fraud Reduction:* IoT data provides objective evidence of incidents (e.g., speed at time of impact), accelerating claims settlement and reducing fraud.
- *Environmental Monitoring:* Sensors in agriculture or logistics track conditions like temperature and humidity, mitigating risks for cargo and reducing waste.

Secondly, ***Blockchain for traceability*** is worth mentioning. It refers to using decentralized, immutable digital ledgers to track the entire lifecycle of a product or asset - from production and use through repair, reuse, and recycling - to enable more accurate risk assessment, automated claims processing, and sustainable underwriting in a circular economy. By ensuring that data regarding the origin, ownership, and condition of a product is authentic

and tamper-proof, blockchain allows insurers to move from traditional linear (take-make-dispose) insurance to a circular, data-driven model. (Awasthy et al., 2025), (Revivack, 2024).

Thirdly, ***AI for claims optimization*** in circular insurance requires examination, which refers to using artificial intelligence - specifically predictive analytics, computer vision, and generative AI - to accelerate, automate, and make more precise the process of assessing, repairing, and settling claims within a circular economy framework. Unlike traditional "linear" insurance (take-make-waste), circular insurance focuses on repairing, reusing, and recycling assets. AI optimizes this by enabling faster claims handling, reduced manual tasks, and improved customer experience, while fostering sustainability by favoring repair over replacement. (Alex Pezold, 2025), (V7Labs, 2025).

The development of circular insurance faces a number of challenges (Evolveable Consulting, 2024), (Hersch et al., 2024), (INGKA, 2023), (Kirchherr et al., 2018), (Mukhopadhyay, 2023), (Swiss Re, 2023):

- *Limited Data and Risk Assessment:* Effective circular insurance requires high-quality, reliable data to assess risk. The lack of standardized data for refurbished items creates uncertainty in pricing and underwriting. Circular economy models, such as remanufacturing, renting, or repairing, lack extensive historical data. Insurers struggle to quantify the risks of novel technologies and materials, making it difficult to underwrite them. This "data gap" makes it difficult to predict failure rates, product lifespans, and, consequently, to price premiums accurately.
- *Increased Fire and Property Risks:* During the period 2025-2026, there is a sharp increase in the risks of fire and property damage, driven by climate change, urban expansion and increased levels of industrial hazards. Recycling facilities, which are crucial to circularity, often involve high combustibility and unpredictability. Past large-loss fire incidents have resulted in limited insurance capacity, higher premiums, and reduced insurability for these entities.
- *Regulatory Hurdles and Uncertainty:* Existing insurance regulations are designed for traditional products and often do not accommodate the unique characteristics of circular economy contracts, such as pay-per-use or sharing schemes, leading to compliance hurdles. Circular business models often involve remanufactured, repaired, or shared products. Insurers face uncertainty in determining liability if a refurbished product fails, as the original manufacturer might not be the entity repairing or selling it. Insurance regulations are often fragmented by region or sector, particularly in hybrid products (e.g., travel insurance), creating uncertainty about which rules apply. This restricts the introduction of modular or flexible coverage, which is essential for circular products.
- *Lack of Standardization:* There is an absence of global standards for recycling operations and circular products. Industry classifications are inconsistent, preventing insurers from applying standardized risk management practices.
- *Complex Supply Chains:* Circularity requires close coordination between multiple stakeholders (manufacturers, repair shops, recyclers, users), which complicates risk management and insurance logistics. Setting up logistics for collecting used items, testing their safety, and reconditioning them requires significant financial outlay and partnership development. In complex, interconnected supply chains, this means

insuring against risks associated with reverse logistics, the quality of recycled materials, and the reliability of partners in a closed-loop system.

- *High Initial Costs*: While circular insurance promises long-term savings and risk reduction, the initial transition phase often faces prohibitive expenses. Implementing circular models often requires high upfront investment in new technologies, training, and operational restructuring, which can be prohibitive. Insurers must invest heavily in new technology, including IoT (Internet of Things) devices for monitoring assets and data analytics systems to track product lifecycles, enabling repair or reuse rather than replacement. Implementing circular models requires substantial resources for developing new workflows, retraining staff, and restructuring claims management systems to prioritize repair and refurbishing over cash settlements. Insurers often require in-depth, regular property assessments of recycling and refurbishment facilities, driving up the cost of underwriting risks for circular businesses. In some cases, the initial insurance fees for companies applying circularity can be higher due to the unknown risk profiles of new, innovative materials or processes.
- *Socio-Cultural Barriers:* These barriers stem from established consumer mindsets, hesitancy within companies to change traditional business models, and a general lack of awareness regarding the benefits of a circular economy. A strong "ownership" culture in many regions creates resistance to renting or sharing models, limiting the demand for products supported by circular insurance.

# Conclusions

Circular insurance in the context of the circular economy represents an innovative approach to the insurance sector, adapted to support the transition from the linear economic model ("produce-use-dispose") to a circular one, which prioritizes the reduction, reuse, repair and recycling of resources. Unlike traditional insurance that often replaces damaged products (leading to waste), circular insurance encourages the repair, refurbishment and extension of product lifespans. Circular insurance is not just a simple financial product, but an essential tool for reducing risks in the green transition, focusing on long-term value and sustainability. It covers emerging risks related to recycled materials, new recycling technologies and green production processes and focuses on a better understanding of the risks associated with secondary raw materials (recycled materials) and their reliability in production.

Circular insurance products, in the context of the circular economy, are innovative financial instruments designed to support business models that prioritize waste reduction, resource reuse, repair and recycling. These include insurance for PaaS models, repairability and refurbishment insurance, insurance for circular supply chains, liability insurance for waste management, insurance for emerging risks. The main challenges identified include the lack of historical data and risk uncertainty, the complexity of damage assessment, environmental and legal liability, high initial costs, regulatory and technical obstacles.

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