



WHITEPAPER

Smart Circularity: How Data Intelligence Drives Circular Economy Growth

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Executive Summary

This whitepaper explores **how AI-powered data intelligence accelerates decision-making at scale**, uncovering new material opportunities and optimising supply chains. As industries face increasing pressure to increase recyclability, source renewable materials, and build more resilient and sustainable supply chains, the circular economy presents a transformative path forward. **Yet its complexity demands smarter and more efficient tools for successful circular business implementation.** Concrete use cases and a real-world case study demonstrate how AI-powered solutions can turn data into actionable, industry-specific circular strategies. You will gain insights into current challenges, the limitations of existing tools, and how AI-driven intelligence enables measurable impact, profitability, and long-term sustainability.

7.2%

global circular material
use rate in 2023
(CGR,2023)

~\$4.5 Tn

projected global
economic output of
circular economy by
2030 (UNCTAD, 2024)

>170 Gt

extracted materials in
billion tonnes (Gt)/year
(CGR 2023)

Introduction

The Shift to a Circular Economy

Advancing global environmental objectives, like the UN Sustainable Development Goals or the EU's goal of achieving climate neutrality by 2050, highlight the importance of a circular economy. Unlike the traditional “take-make-dispose” model, circularity keeps resources in use, designs out waste, and regenerates ecosystems. For businesses, this means reimagining products, processes, and supply chains, from linear efficiency to circular resilience.

Yet, progress remains slow. In 2023, only 7.2% of global circular materials were used (CGR, 2023). Reaching true circularity requires more than intent—it demands advanced tools that can tackle complexity at scale.

AI as a Game Changer in the Circular Economy

Artificial intelligence is providing circular opportunities that were previously out of reach. Its ability to process vast datasets, identify patterns, and generate insights makes it a key enabler across three core areas:

- **Circular product design:** AI supports circular design by analysing alternative renewable material opportunities.
- **Material recovery:** AI-powered systems improve waste sorting accuracy and reduce contamination.
- **Supply chain optimisation:** AI enables predictive sourcing and efficient resource use across circular value chains.

With raw material extraction projected to rise by 60% by 2060 (Nature World News, 2024) and regulations driving the shift to local, renewable input materials, the urgency to find alternatives is growing. AI can play a crucial role by identifying suitable renewable materials and feedstocks, and matching them to specific applications.

A Smart Path to Profitability and Resilience

Integrating AI into circular strategies isn't just about sustainability. It's a strategic advantage. Smarter resource use, reduced waste, and innovative business models unleash efficiency, revenue, and resilience. Companies that act now gain a competitive edge and stay ahead of the competition and regulations.

Challenges in Transitioning to a Circular Business

Shifting from a linear to a circular business model is not a simple swap, as it requires companies to rethink how they create, deliver, and capture value. While the **circular economy promises up to \$4.5 trillion in global economic opportunities by 2030** (UNCTAD, 2023), most companies face **deeply rooted challenges** that slow or stall implementation. Outdated industrial models, market incentives, and technological fragmentation shape these systemic and operational barriers.

Technological Gaps and Integration Barriers

The rapid pace of innovation and fragmented knowledge make it hard for companies to keep up. **Integrating AI into existing operations is complex and demands technical expertise.**

Limited Circular Solutions Overview

Managing and scaling a circular business is difficult without a comprehensive overview of materials, technological innovations, supply partners, and relevant market data. **Companies need a centralised platform** to access and connect these elements.

High Costs and Time-Consuming Research

Circular transitions often require **high upfront investments and specialised infrastructure**. Even with data-driven research, companies often have limited access to the comprehensive, global datasets, impeding informed strategic decision-making.

Difficulty Sourcing Renewable and Regional Feedstocks

Finding regional renewable feedstocks is difficult due to **limited supplier insights, higher costs, and regulatory complexities**. Global supply chains prioritise efficiency over circularity, leaving businesses with little visibility into regional resources and side-streams.

Leveraging the Power of AI for Advancing Circularity

While AI is already playing a significant role in accelerating circular business models, most solutions fall short of delivering complete, viable solutions for circularity. Most AI-driven solutions on the market target specific tasks, lack access to global data, and provide only partial insights, making it challenging to implement circular strategies in a meaningful and connected manner.

The Gaps in Existing AI Solutions

Today's AI solutions, enhancing waste sorting, supply chain management, and material design, are useful but limited in several key ways:

- **Lack of industry-specific customisation:** Usual platforms provide solutions designed for all industries, disregarding tailored solutions based on the company's sector, size, or circular maturity.
 - **Missing expertise:** Current AI tools are often developed without in-depth involvement from experts in the circular economy and process technology domains, limiting their ability to leverage AI reliably.
- **Isolated functionality:** Solutions focus on individual parts of the circular business, such as patent analysis or supplier mapping, without covering the entire spectrum.
 - **Limited data coverage:** Many solutions lack access to global, high-quality data sources, restricting the scope of insights and opportunities they can uncover.

A New Approach: Comprehensive Intelligence For The Circular Industry

To overcome these limitations, **companies need a comprehensive intelligence platform that goes beyond isolated functions.** Advanced AI enables the development of circular solutions tailored to a company's industry, operations, and strategic goals, connecting them directly to relevant partners and real-time market data. Our proposed solution leverages advanced analytics and global market intelligence, allowing companies to access a **clear, end-to-end overview of circular opportunities**, from feedstock to market applications.

Case Study: Using VCG.AI's Intelligence

Example: Turning Ethylene Glycol Into a Circular Product

VCG.AI, a data intelligence platform, enables the production of Ethylene Glycol (EG), a widely used industrial compound, using renewable feedstocks. Leveraging its vast global database and data analytics, the platform **identified the most profitable and sustainable pathways**, creating a viable business model to produce sustainable EG.

How VCG.AI Discovered a Circular Solution for EG

Situation

A chemical company sought to produce renewable Ethylene Glycol (EG) to **reduce dependency on fossil-based feedstocks** and move toward a circular production model.

Challenges

- Limited visibility of viable renewable feedstock options
- Lack of integrated data

This made it difficult to evaluate technical feasibility and develop a clear roadmap for renewable EG production.

VCG.AI Analytics

The following data was analysed:

- Technology landscape and TRL analysis
- Technical value chain concepts
- IP landscape
- Start-ups and new technologies scenario
- Scientific publications landscape
- Company reports
- EU project reports

Case Study: Using VCG.AI's Intelligence

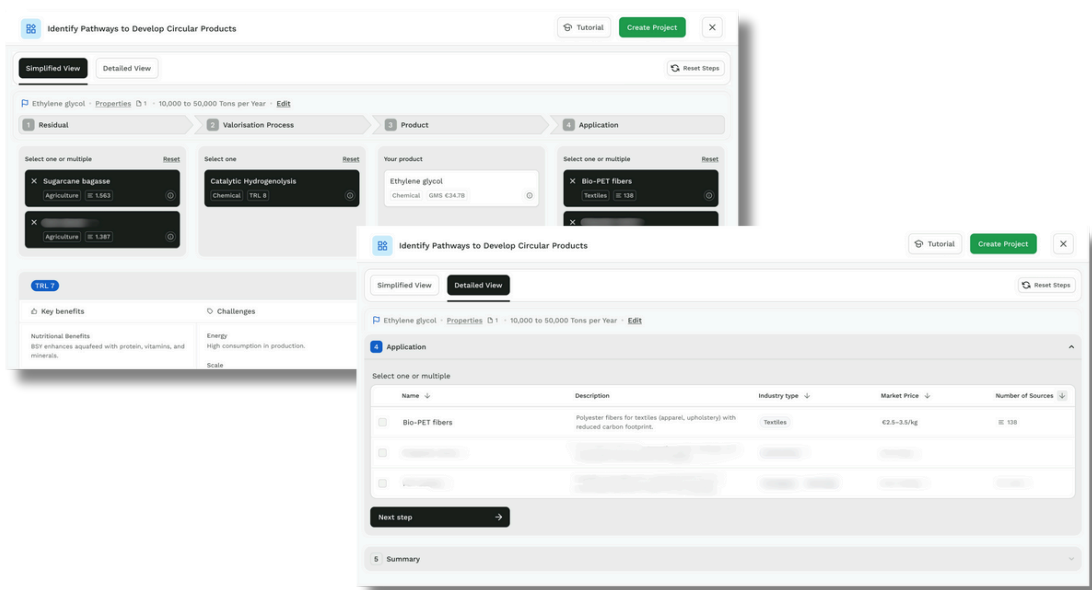
Outcome

Using VCG.AI's data intelligence platform, our client gained clarity and the **relevant insights for strategic decision-making**. Providing a detailed value chain analysis for every step, from feedstock to market application, VCG.AI delivered:

- **45+** viable renewable feedstocks identified
- **15+** valorisation processes ranked by TRL to evaluate technical feasibility
- **8+** market applications
- **21,000+** suppliers across the EU producing the right feedstock
- Market off-taker list

Key Takeaways

With these insights, the company defined a complete circular solution for renewable EG, identifying the most promising feedstocks, technologies, and partnerships to **drive sustainable, data-backed innovation**.



Accelerate Your Circular Transition with VCG.AI

About VCG.AI

At VCG.AI, we made it our mission to build the **global map for industrial circularity**; mapping the pathways, future supply chains and market dynamics that will define the **shift to a circular and bio-based economy**. VCG.AI is a data intelligence platform that enables organisations to build more resilient circular supply chains. The platform supports innovation, business development, sustainability, and sourcing teams by delivering the insights needed to help them **make faster strategic decisions**. It brings together real-time data on renewable feedstocks, technologies, suppliers, markets, regulations, companies, and strategic partnerships to scale circular business models.

Connect with VCG.AI

VCG.AI is **already deployed by organisations in over 15 European countries** and has been awarded the prestigious €2.5M EIC Accelerator deep-tech grant to scale the most impactful circular technologies and approaches across industries.

VCG.AI provides **global circular intelligence** to accelerate your transition to the circular industry.

Get in touch or **book a demo** to learn how VCG.AI can help your company turn complexity into circular opportunities— <https://vcg.ai/demo/>.



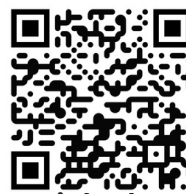
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Book a demo

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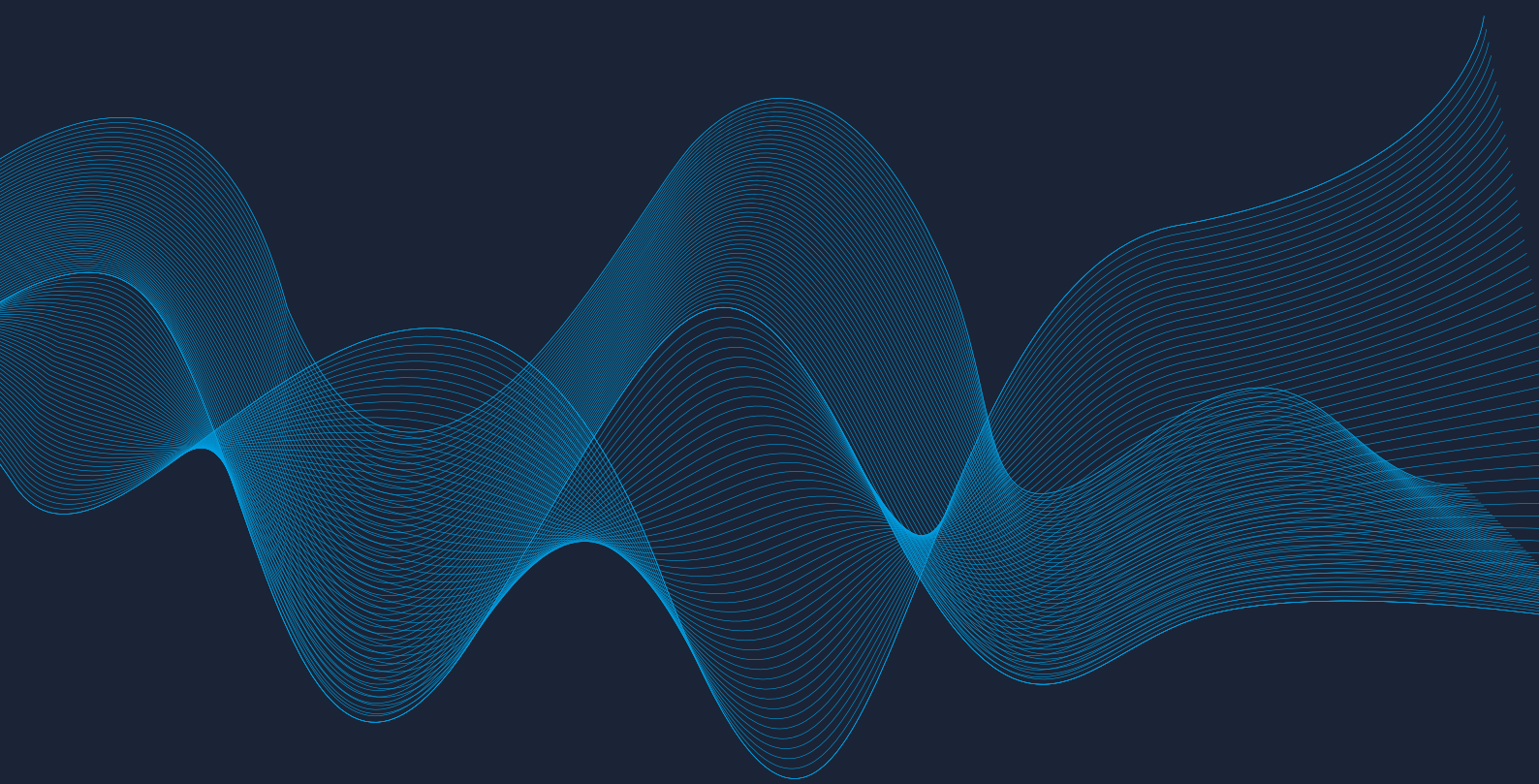
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**The Most Comprehensive Data Intelligence Built For
The Circular Industry**



<https://vcg.ai>