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Circular Intelligence Applied to Lignocellulosic Biomass Management

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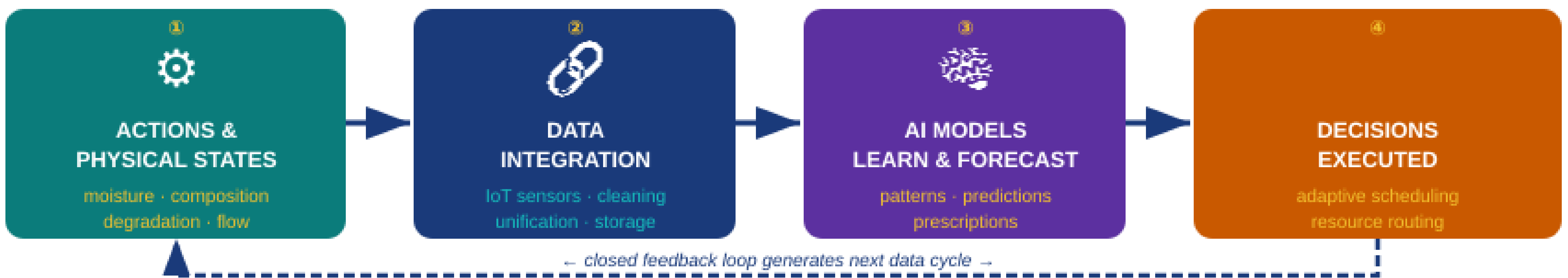
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Circular Intelligence is defined as the integration of **Artificial Intelligence (AI)**, **Big Data Analytics**, and the **Internet of Things (IoT)** into operational circular economy models – enabling real-time visibility, control, and evidence-based decision-making across material flow systems.

THE CIRCULAR INTELLIGENCE CONTROL LOOP



FIVE DIFFERENTIATING ATTRIBUTES OF CIRCULAR INTELLIGENCE PLATFORMS

Full Life-Cycle Perspective

Traces materials from generation through all valorization pathways – not only end-of-life handling.

Heterogeneous Data Integration

Consolidates operational, commercial, regulatory, and environmental data into a unified material-flow view.

Circularity-Oriented Prediction

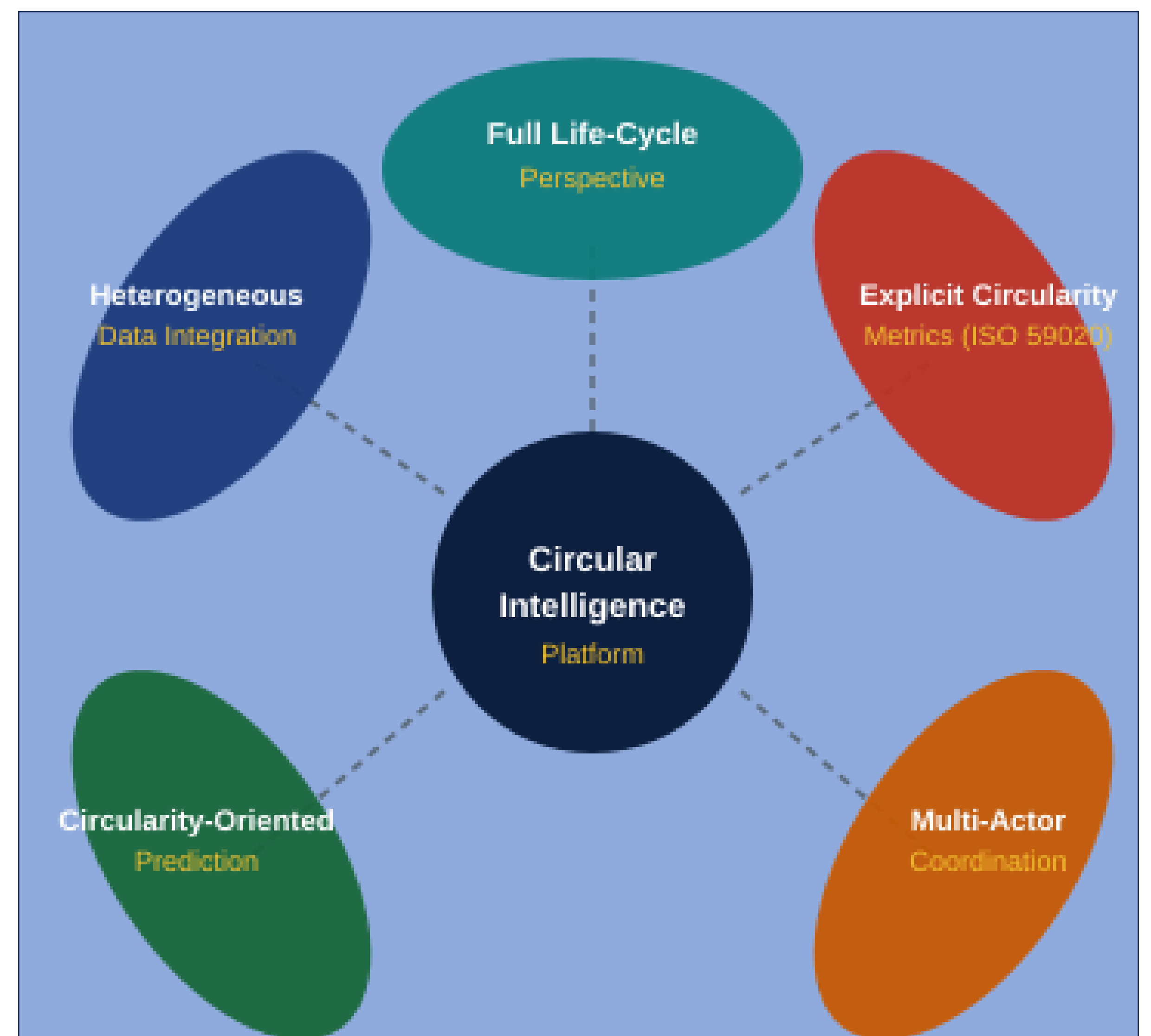
Forecasts availability and quality of secondary materials – critical for seasonal lignocellulosic biomass supply.

Multi-Actor Coordination

Connects generators, operators, recyclers, manufacturers, and authorities through shared data and process rules.

Explicit Circularity Metrics

Computes loop closure, product-life extension, and CE objectives. ISO 59020:2024 provides standardized indicators.



Lignocellulosic Biorefinery

Predictive supply & quality management

Circular Intelligence platforms enable forecasting of lignocellulosic biomass availability, seasonal quality variation, and logistics optimization for biorefineries – directly supporting the valorization of olive tree pruning, agricultural residues, and similar feedstocks.

Circular Intelligence provides an operational approach to make circular bioeconomy goals measurable and actionable. By integrating **IoT sensing, big data analytics, and AI** into closed-loop decision cycles, organizations can reduce collection and processing waste while increasing recovery rates. This enables high-value valorization of **lignocellulosic residues** through advanced biorefineries and allows documentation of compliance and environmental outcomes in near real time.

The highest value is reached when isolated optimizations are elevated into **platform-based coordination and standard-aligned measurement (ISO 59020:2024)**.

✓ CONCLUSION

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