CCES 2025 Session Summary

Tech-Driven Transformation: Harnessing the Fourth Industrial Revolution for a Circular Economy

The circular economy transition across all sectors can be enabled by digital, physical, and biological technologies and platforms, from artificial intelligence (AI), to robotics, digital platforms, blockchain, and bio-based materials. The characteristics of these technologies enable a shift towards circular business models by increasing energy and process efficiencies, reducing waste, improving information/data sharing and networking, enhancing supply chain transparency for the flow of goods and secondary materials, and supporting circular design and the adoption of regenerative bio-based feedstocks. This session explored how disruptive and emerging technologies can be harnessed, accelerating tech-driven transformations to a more sustainable, low-carbon, and circular economy.

Date / Location: Wednesday, April 16, 2025 / Montreal, Canada

Speakers

- **Rosalie Simard**, Projects & Partnerships Director, 2 Degres (moderator)
- **Eric Camirand**, CEO, Waste Robotics
- **Michael Dorrington**, Manager of Strategic Partnerships, Ontario Genomics
- **Eliot Assimakopoulos**, CEO, Realizse
- **Maxime Potvin**, Co-founder & CEO, Twenifor

SESSION SUMMARY

This conference session explored various technological and scientific approaches enabling the transition to a circular economy, featuring presentations from leaders in robotics, genomics, blockchain, and digital platforms.

Opening Perspectives

The Physical Perspective: Waste Robotics

Eric Camirand, CEO of Waste Robotics, presented on the application of robotics to the circular economy. His company, established nine years ago, focuses on developing and deploying robots for waste sorting. Eric highlighted the immense scale of global waste generation, citing a figure of 10 billion tons per year, equating to 45 trucks of waste generated every second. He emphasized that while household recycling (plastics, paper) is crucial for public awareness, it represents only 7% of the total waste stream; the larger challenges lie in construction and industrial waste.

Waste Robotics has 30 installations worldwide, with approximately 100 robotic arms operating continuously. Eric underscored the significant environmental and social impact of their technology, noting that robots perform tasks that are dangerous and undesirable for humans. He stressed the importance of combining advanced AI, hyperspectral imaging (to "see" product chemistry), and 3D sensing with human expertise for installation, maintenance, and ongoing improvement. The company's global reach, particularly in Europe, Australia, and Canada, is facilitated by technology that allows for remote support, requiring only local hands for physical adjustments.

Eric showcased examples of their robots in action, including a compact four-arm cell in Italy sorting plastics, and robots in Australia picking up Tetrapak (funded by Tetrapak itself for material capture). He also described their work in France, where robots sort recyclables from mixed waste prior to incineration, demonstrating their ability to recover materials even in less-than-ideal collection systems. Regarding commercialization, Eric revealed that while they had their first application within nine months of startup, the initial 5 years were challenging, marked by "a lot of breakage" and learning curves due to the harsh realities of the waste industry. Product maturity and significant growth, doubling every year, have been achieved in the last five years, coinciding with the beginning of the COVID-19 pandemic.

The Biological Perspective: Ontario Genomics

Michael Dorrington, Manager of Strategic Partnerships at Ontario Genomics, discussed how DNA and genomics can unlock the world's circular economy. He explained that genomics, the study of DNA structure and function, has evolved dramatically; sequencing a human genome now takes hours and costs hundreds of dollars, compared to 12 years and $2.7 billion historically. This advancement enables the engineering of new DNA systems and biochemical pathways, primarily within microbes (bacteria and yeasts), to create new capabilities.

Michael linked this to the circular economy by highlighting that natural economies are inherently circular, like the water and carbon cycles. Human exploitation of the carbon cycle, particularly through fossil fuels, has led to climate imbalance. By integrating biology into the economy, creating a "bioeconomy," the carbon cycle can be rebalanced. He focused on food waste, a significant contributor to the agri-food sector's environmental footprint. Instead of just reducing waste, bio-conversion can upcycle it into new products.

Microbes can be engineered to take organic waste as input and convert its nutrients into valuable outputs like bioplastics, textiles, dyes, food ingredients, and platform chemicals. Michael highlighted several Canadian startups in this field:

- **Dispersa:** Converts food waste into biosurfactants, replacing fossil fuel-derived synthetics.
- **MetaCycler BioInnovations:** Uses sugar-rich feedstocks (e.g., dairy waste) to produce biodegradable plastics.
- **Terra Bioindustries:** Extracts valuable chemicals (proteins, sugars) from side streams like brewer's spent grains using tailored enzymes.
- **Material Futures:** Uses food waste to feed bacteria that produce fade-resistant natural dyes.

Despite the potential, roadblocks exist, including access to affordable bioreactor infrastructure for scaling, consistent biomass supply (high availability, low variability, minimal contamination), and buy-in from end-users willing to test and commit to buying bioproducts. To address these, Ontario Genomics created the *WasteCANCreate Upcycling Consortium*, which brings together feedstock providers, technology developers, and end-users to create and fund value chain projects. This consortium, which includes small and medium enterprises, large companies, and government representatives, held an inaugural summit a year ago and will release a follow-up report soon.

The Blockchain Perspective: Realizse

Eliot Assimakopoulos, CEO of Realizse, presented on how decentralized or blockchain technology can scale circularity by addressing two major roadblocks: lack of real-time traceability and limited access to capital. He explained that decentralized technology operates on a network of computers where data is shared transparently, trustfully, and immutably among participants, unlike fragmented centralized systems.

This technology promises to eliminate scaling barriers through traceability and validation, enabling secure tracking of supply chains and data collection. When integrated with tokenized finance—the creation of digital representations of assets (tokens)—it can unlock liquidity for circularity projects. Eliot referenced Larry Fink of BlackRock, who predicts the tokenization of every financial asset, democratizing finance and potentially opening up 95% of global investment capital (currently in public markets) to circularity projects.

On the traceability side, Realizse's decentralized network allows each stakeholder, including consumers, to digitally integrate and validate data. He cited a project with Alberta Innovates where serialized QR codes on plastic bales track their journey from source through transformation (e.g., from bale to flake bags), providing irrefutable proof of provenance. Future phases will integrate consumers and tokenized project finance.

On the tokenized finance side, Realizse aims to fractionalize ownership of assets (like a materials recovery facility, or MRF) by creating digital tokens that can be bought and traded by various investors, including institutional, accredited, or even the local community. Smart contracts can then automate fund distribution based on validated outcomes (e.g., amount of plastic recycled). Eliot concluded that this new era of funding relies on trusted data, automated smart contracts, and democratized access to finance through tokenization, integrating circularity validation with capital.

Realizse aims to enable brand owners to validate sustainability claims, provide project developers with unprecedented capital access, and offer investors direct, yield-generating project opportunities. He clarified that "tokenization" refers to digitizing securities under regulatory frameworks, moving beyond the common association with Bitcoin to fractionalize real-world assets and unlock private market capital by integrating transparency with the tokens.

The Digital Platform Perspective: Twenifor

Maxime Potvin, Co-founder and CEO of Twenifor, an Indigenous and Quebec-based start-up, introduced his company's new online marketplace for the construction and civil engineering sectors. He explained that a significant amount of overstock and reusable materials from deconstruction sites are currently sent to landfills. Recognizing that 30-40% of global waste originates from construction, Twenifor, founded in 2020, aims to address this by adapting the familiar concept of an online marketplace to the specific needs of construction entrepreneurs.

Twenifor facilitates the re-use and sale of materials by offering container services to streamline the transition for businesses. These containers, traditionally used for waste, are repurposed to collect valuable materials for sale on the digital platform. This service allows large contractors to demonstrate significant waste diversion—for instance, a project with Rio Tinto diverted 100 tonnes of wood in one month, projected to reach over 1,200 tonnes annually. For the future, Twenifor envisions a specialized "Amazon" for construction materials, with distribution centers across Quebec, Canada, and eventually globally, enabling direct delivery to customers.

Maxime acknowledged the traditional nature of the construction industry and the challenge of changing established habits. He explained that Twenifor's success stems from simplifying the process and integrating their container service, which is familiar to contractors. While there's still a need for education and awareness about the ecological transition, he noted a growing openness since 2020. Twenifor focuses on securing major clients to build credibility and spread the message that circularity is a viable and beneficial solution for businesses.

Panel Discussion

The panel discussion explored major misconceptions about each technology and the progress made in advancing the circular economy.

Misconceptions:

- **Genomics (Michael):** People often associate genomics solely with human health, overlooking its vast applications in agriculture, manufacturing, and the circular economy. Additionally, there's a misconception that biological technologies aim to *replace* traditional industries; instead, they seek to help these industries extract maximum value from existing processes and waste streams.
- **Blockchain (Eliot):** The primary misconception is equating blockchain with cryptocurrencies and speculative assets like Bitcoin. Eliot clarified that blockchain's true revolutionary potential lies in digitizing real-world assets and securities, creating "programmable money," and automating business functions based on real-time data, much like the analog-to-digital revolution brought by the internet.
- **Robotics (Eric):** People tend to view AI robots as "magic," underestimating their need for maintenance and their potential for evolution through software and gripper changes. Eric emphasized the significant, often unmonetized, social capital gained by replacing humans in harsh waste sorting conditions, improving worker safety and reducing liabilities.

- **Digital Marketplace (Maxime):** While not a prejudice, the biggest challenge is changing the mindset of Quebec's construction sector. Potvin stressed the need to demonstrate long-term viability and effectiveness, showing that Twenifor is a lasting, impactful solution, particularly by proving that the circular economy model for construction materials genuinely "turns" with sufficient demand.

Progress and Future Outlook:

- **Blockchain (Eliot):** Significant progress has been made in using blockchain for tracking and tracing supply chain participants. The crucial next step is to integrate this validated traceability with funding, driven by recent advancements in regulatory frameworks for tokenization.
- **Genomics (Michael):** Progress is twofold: technical advancements making biology easier to manipulate (e.g., mRNA vaccines, CRISPR), democratizing access to these tools; and increased education and understanding among government levels, recognizing that bio-technologies are not sci-fi but actively deployed solutions. He highlighted Canada's potential to lead in the bioeconomy due to its abundant biomass resources.
- **Digital Marketplace (Maxime):** Maxime has observed increased engagement from various stakeholders and government funding in the last few years. He pointed to successful examples of companies like Brique Recyq's recycled bricks as proof of viable, innovative solutions. He stressed the ongoing need to demonstrate Twenifor's viability and to foster public and corporate participation to ensure a thriving circular economy where overstock materials find buyers.

Collaboration and Knowledge Sharing:

The panelists unanimously agreed that collaboration is crucial for advancing the circular economy.

- **Maxime:** Emphasized the need for all stakeholders to connect, share knowledge, and support each other to ensure the circular economy gains momentum and visibility.
- **Michael:** Highlighted the necessity of collaboration across specific value chains (feedstock providers, technology developers, end-users) and across different technologies. He noted that AI and automation are vital for large-scale industrial systems, online marketplaces for connecting bio-material suppliers with manufacturers, and new financing methods are essential for large-scale projects. He even mentioned DNA-based barcodes as tamper-proof alternatives to QR codes for traceability.

- **Eliot:** Stressed that funding is essential for any project or technology. He sees a new era where companies can raise capital by tokenizing shares, allowing broader access for both institutional and individual investors who care about both financial returns and planetary well-being. He believes this is applicable across all industries but particularly transformative for circularity.

The session concluded with questions from the audience, further exploring the practicalities of Twenifor 's container service costs (demonstrating it's cheaper than waste disposal in the long run) and safeguards against speculation in tokenized assets (distinguishing between real-world asset tokenization and speculative cryptocurrencies). The panelists emphasized that tokenizing real-world assets falls under existing securities regulations, ensuring compliance and investor protection.