Technology-driven circular economy solution: LanzaTech – India Glycols – Unilever Case Study

Executive summary: Advances in technology provide circular businesses with greater possibilities. Our LanzaTech – India Glycols – Unilever Case Study demonstrates a notable example of utilizing new technologies to innovate business models, create values, and simultaneously reduce carbon emissions. This case highlights a collaboration between LanzaTech (Technology provider), Shougang Group (Steel Manufacturers), India Glycol (Specialist chemicals manufacturers) and Unilever (Product Manufacturer) to produce more sustainable detergent products, such as laundry capsules and dishwasher liquid.

The challenge: Around 80% of chemicals are derived from fossil fuels, and refining and manufacturing processes are not always as clean as they could be. While the chemical industry is making efforts to implement changes, developing a circular model presents extra challenges. Chemical products tend to be consumables and are difficult to recover once utilised. For example, it would be near impossible to retrieve fertilisers from the ground, or shampoo from drains once they have been used. In such cases, the focus should be on using more sustainable raw materials in production. However, finding ways to produce these products more sustainably while maintaining affordable prices remains a significant challenge for companies.

Results obtained at CircularChem: We have conducted several case studies to investigate how companies in the chemical sector transit their businesses towards a circular economy (CE). The LanzaTech – India Glycols – Unilever Case Study is one such example, showcasing the power of technological advancement and value chain collaboration in accelerating CE in the chemical sector, which is one of the largest carbon-emitting industries.

Overview of the Collaboration: LanzaTech is a technology company that has pioneered a process for producing ethanol from captured carbon. In 2011, it formed a joint venture with Shougang Group—Beijing Shougang LanzaTech New Energy Technology—to build a facility in Hebei province, China. This plant captures carbon emissions from steel

manufacturing and produces ethanol which is then sold as chemical base material. The revenue is shared between Shougang and LanzaTech.

India Glycols further processes this ethanol to produce surfactants, which Unilever uses in its detergent formulations. In 2021, Unilever launched these products in China, Germany and South Africa. Despite positive customer feedback, the products did not align with Unilever's traditional business model due to the significantly higher cost of the recycled carbon-based surfactants. In most cases, companies producing consumer products need each product to meet sales and profitability targets before they are launched. In this case, it is a credit to Unilever, a purpose driven company with sustainability being at the core of its purpose, that they decided to launch these products (i.e., doing the right thing) despite its business model (i.e., financial performance).

Value Creation and Capture Across the Ecosystem: The table below summaries the distinct roles each company played in creating, delivering, and capture value in the business ecosystem:

Company	Value Proposition	Value Creation & Delivery	Value Capture
LanzaTech	Customised technology enabling circular carbon recycling from industrial emissions.	• Intensive R&D and market analysis. • Customisable and adaptable technology for different waste inputs and product outputs.	• 'Plug-in' technology integrated into existing steel facilities, reducing capital costs. • Royalties from detergent sold. • Establishes a global reputation as a leader in carbon recycling.
Shougang Group	Supply of carbon through industrial emissions.	• Reduction in emissions, enhancing reputation and mitigating potential future carbon taxes. • Provision of large-scale carbon supply.	• Creation of intangible value through sustainability efforts. • Revenues generated through ethanol production.
India Glycols	Conversion of ethanol of any origin into surfactant.	• Established chemical process operating at large scale.	• Revenues from contracted services. • Cost efficiencies through economies of scale.
Unilever	High-quality, affordable, and	• Global established manufacturing and distribution networks.	• Higher manufacturing costs.

	more circular product.	• Established brand awareness and customer loyalty.	• Potential pricing risks if production costs increase. • Positions itself as a market leader ('vanguard') in producing circular detergents.

Wider implications and working with partners: This case study indicates **key lessons** for businesses that intend to adopt CE principles.

- **Circularity is achieved through collaboration.** No single firm can achieve circularity alone; it requires multiple companies working together to create a functional ecosystem.
- **Different roles within the system.** While some companies (e.g., India Glycols) engage as part of their usual business operations, others (e.g., LanzaTech and Shougang) invest in new technologies to capture and process waste with a clear return on investment, and others take the risk of launching sustainable products despite financial uncertainties (Unilever).
- **Circular feedstocks remain costly.** Recycled carbon-based materials are significantly more expensive than their fossil-based counterparts, creating financial challenges for adoption.
- **Technology providers can drive ecosystem orchestration.** LanzaTech, as a technology innovator, played the central role in orchestrating partnerships and driving the transition toward a circular model.

This case highlights both the opportunities and challenges of industrial symbiosis in achieving circular economy goals, demonstrating the importance of technological innovation, strategic partnerships, and corporate sustainability commitments.

References

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