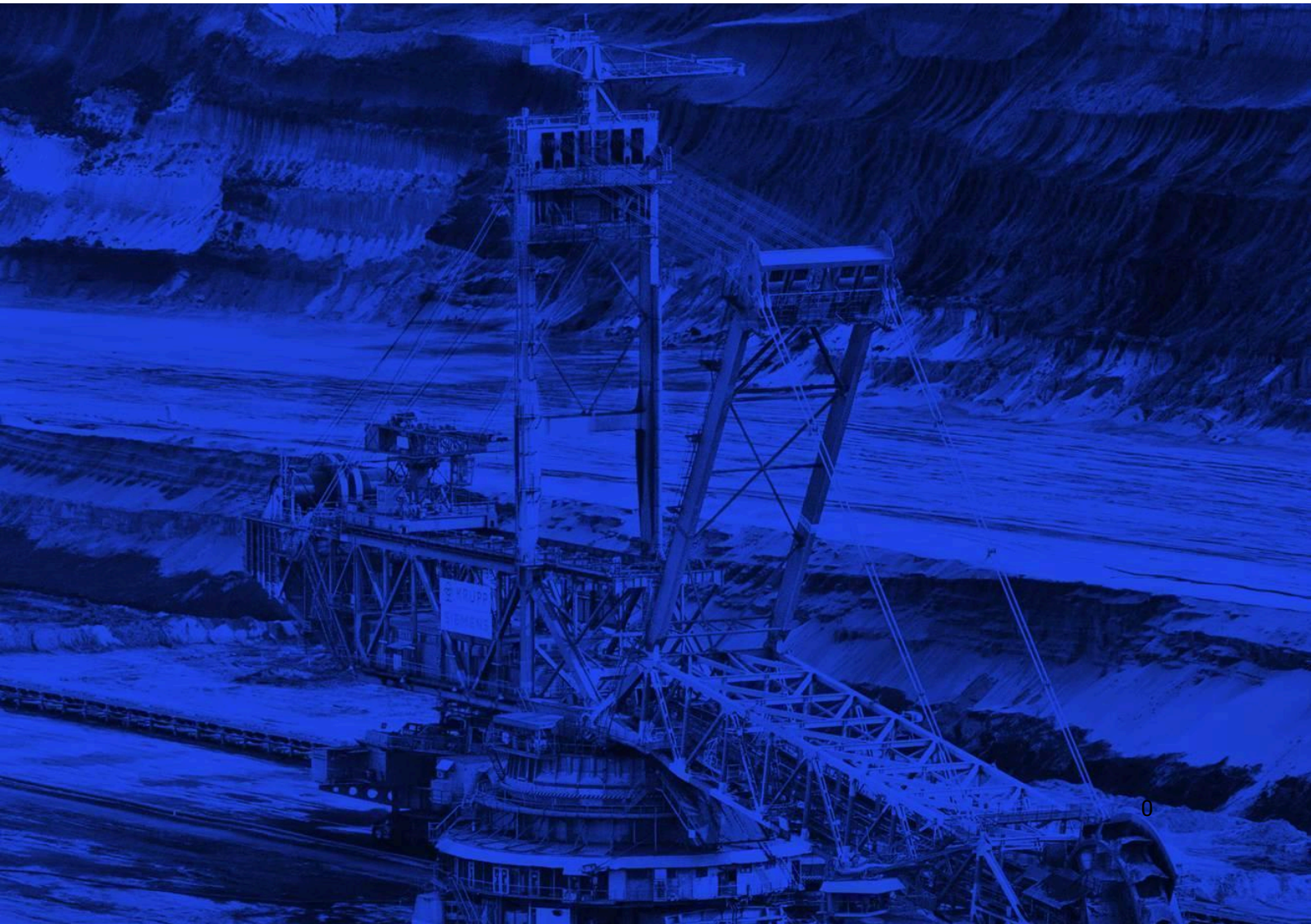
Columbia Center on Sustainable Investment
A JOINT CENTER OF COLUMBIA LAW SCHOOL AND COLUMBIA CLIMATE SCHOOL

CARBON TRUST

Metals-as-a-Service July 15, 2025 Workshop Outcome Document

July 2025



About the workshop

Title: Metals-as-a-Service: From Challenge to Design. Closed-Door Strategy Workshop
Date: July 15, 2025
Location: London, Carbon Trust Arbor Office
Attendees:

Organisation	Representative	Title
Anglo American	Dawn Brock	Principal Land and Water Stewardship
Chatham House	Patrick Schroeder	Senior Research Fellow
The Copper Mark	Mike Smith	Director of Value Chains
EMR Group	Patrick Davison	Sustainability Director
EMR Group	Guy Mercer	Sustainability Director
Glencore	Kunal Sinha	SPV Marketing and Global Head, Recycling
International Copper Association (ICA)	Louise Assem	Vice President, Science and Regulatory Affairs
International Council on Mining and Metals (ICMM)	Will Wardle	Senior Programme Officer
International Finance Corporation	Marion Guimard	Industry Specialist – Global Infrastructure – Metals & Mining
Jaguar Land Rover (JLR)	Peter Tindall	Battery Lifecycle Senior Manager
Jaguar Land Rover (JLR)	Julia Bailey	Sustainability Senior Manager
London Metals Exchange	Osher Beveridge	Assistant Vice President, Sustainability and Physical Market Development Manager
University of Oxford	Konstantin Born	PhD at Smith School of Enterprise and the Environment
Quadrature Climate Foundation (QCF)	Madeleine Luck	Science Lead
Sura	Sarah Grison	Circularity Expert
Teck Resources	Catherine Adair	Director, External Engagement, Europe
Trafigura	Guy Henley	Senior Sustainability Manager
Trafigura	Claudia Alvaro	Metals Analyst
Trafigura	Ashley Woods	Global Head of Environment and Decarbonisation
Vale Base Metals	Christian Spano	Director, Circularity

Introduction

On July 15, 2025, the Carbon Trust and the Columbia Center on Sustainable Investment (CCSI) co-hosted a closed-door strategy workshop in London to explore their prior experiences with, and the challenges and opportunities of adopting Metals-as-a-Service (MaaS) business models. The workshop convened a diverse group of actors from across the metals value chain—including mining, recycling, trading, manufacturing, finance, and policy—to examine how MaaS might unlock the untapped economic value of secondary metals, support circular systems change, and reduce pressure on primary supply. The workshop aimed to: (1) assess the economic potential of MaaS; (2) identify priority areas for further research and piloting; and (3) launch the first community of practice dedicated to MaaS.

The day's sessions were structured to explore systemic drivers and stakeholder perspectives on MaaS, interrogate the MaaS model framing and research directions, and discuss future collaboration pathways. The discussion was rich, candid, and grounded in practical realities thanks to the high level of engagement and openness of participants. Participants at the MaaS strategy workshop represented upstream, midstream, and downstream companies together with selected stakeholders engaged in MaaS or critical minerals circular economy strategy. They engaged vibrantly and positively with the servitisation concept of MaaS, with each sharing experience, ideas, and suggestions on MaaS and the role it could play in closed-loop secondary metals recycling.

The two sessions of the workshop were introduced with presentations by Carbon Trust and CCSI that discussed MaaS as a novel approach to address the systemic pressures on metal value chains, including declining ore quality, long lead times, and rising environmental costs. The Carbon Trust and CCSI highlighted how current circularity efforts—focused narrowly on recycling—are insufficient, and proposed MaaS as a complementary model that redefines ownership and supports long-term recovery of metals. A case study of a Material As a Service Company (MASCO) illustrated how a trust company could retain ownership of materials while supporting users along the value chains, from the material producer to the construction company, with financing and operational services. The second session shifted toward implementation, introducing a research agenda focused on economic analysis, business model innovation, and enablers of MaaS. Participants engaged with potential MaaS archetypes, including performance-based contracts, and examined enabling legal, policy, and financial frameworks—particularly questions of pricing, risk allocation, and traceability. More details about the presentations by the Carbon Trust and CCSI can be found in the annexed slide deck.

The framing elements from these two sessions grounded the rich roundtable exchange. The insights, thoughts, ideas, and concerns of workshop participants are summarised in the key themes below.

1. MaaS business model
2. Ownership and asset management
3. Sector suitability and use case design

4. Value from stock, not just flow
5. Policy, legal, and governance enablers
6. Economic and financial enablers
7. Next steps and strategic framing going forward

This document is intended for both the workshop participants and those who expressed interest but were unable to attend. By sharing these reflections, we hope to support the development of a community of practice around MaaS, one that fosters collaboration, shared learning, and practical innovation across the value chain.

Thematic discussions

MaaS Business Model

Participants broadly recognised MaaS as a promising concept but emphasised that its success depends on how the model is framed, the specific materials involved, and the lifecycle of the assets. Several variants of MaaS were also discussed.

- *From Leasing to Renting to Ownership-based Models:* Initial attempts framed MaaS as leasing, but this proved expensive and unappealing due to long asset lifespans and uncertain returns. Renting provided a more flexible model, enabling the asset to be used by multiple users over time. Eventually, a more nuanced model drawing on analogies from the automotive and housing sectors (e.g., mortgages, secondary markets) was suggested as a way to unlock recurring value and manage ownership complexity over time.

- *MaaS is different from Recycling:* Participants warned against equating MaaS with recycling. The value proposition of MaaS should differentiate this model from both traditional sales models and recycling. MaaS should aim to monetise the *metal in use*, not merely end-of-life recovery. The innovation lies in generating value from the *stock* of materials in the economy, not just from linear *flows*. This is notwithstanding that MaaS' premise is to ensure a higher grade recovery than currently happening.

- *Portfolio approach:* Participants recognised that transitioning to a MaaS business model is likely to be a long-term process, and therefore identified the need to integrate MaaS gradually into existing systems to minimise friction, for example, by positioning MaaS as one of several options within a broader project portfolio.

- *Material nationalism:* There was a discussion around 'material nationalism', whereby the model is state-to-business, not business-to-business, in which the state leases the metal. This model was discussed as considering Indigenous communities and the communities on the mining land as key stakeholders who would receive a financial benefit. While Carbon Trust and CCSI agree that this is a critical consideration, the team explained that it added a layer of complexity that could be more adequately dealt with after establishing the proof of concept for MaaS.

Ownership and asset management

- *Mapping roles and defining ownership:* A recurring theme, prompted by the Carbon Trust and CCSI's presentation of a preliminary MaaS Theory of Change, was the need to reframe stakeholder involvement not in terms of traditional industry categories (e.g., miner, processor, trader, customer), but through functional roles such as "asset owner," "service provider," and "user." Participants emphasised that advancing MaaS will require a shift from analysing risks and benefits for fixed stakeholder types to mapping specific roles, responsibilities, skills, and decision points across each stage of the value chain. Ownership, as one of these roles, emerged as a particularly critical and debated function. Some participants noted that pure-play miners might not see value in retaining ownership of metals if they lack reprocessing capabilities. Others proposed that ownership could still be retained upstream without the material returning to the original owner, as downstream actors such as smelters or refiners could handle reprocessing—potentially with reduced fees as compensation. Traders and intermediaries might also consider taking ownership if it facilitated long-term contracts or customer lock-in.

- This functional framing of roles—paired with an analysis of how value, risk, and responsibility are distributed—was seen as key to identifying viable MaaS business models and the transformations needed to implement them. Beyond that, collaboration and coordination across the supply chain were identified as critical enablers of the MaaS business model.

Demand, Sector Suitability, and Use Case Design

There was agreement that MaaS must be tailored to specific sectors and use cases. An "Aero bar chocolate" analogy was proposed: MaaS will evolve through *multiple small, sector-specific pilots* (bubbles), not a monolithic one-size-fits-all system.

- *Creating Demand*: While participants recognised MaaS concepts as innovative, several of them noted that currently, actual end-user demand remains limited, particularly when offerings deviate too far from traditional procurement models. For MaaS to gain traction, products must be packaged in ways that are familiar, digestible, and attractive to buyers. However, the Carbon Trust and CCSI emphasised that MaaS represents a systems-level shift, and deviations from the norm are to be expected. The project's goal is to develop the knowledge and evidence needed to make the model more concrete and actionable, so that such deviations make economic sense for all actors involved.

- *Piloting:* Participants discussed that some sectors may be less suitable for early MaaS implementation: mining was seen as too upstream and complex, construction as too fragmented and slow to adapt, and the battery sector as risky due to safety and reputational concerns. Therefore, at least in the pilot phase, they suggested the model would work best when limited to one or two value chain steps to avoid complexity. Participants stressed the need to align MaaS deployment with specific sectoral contexts, piloting in environments with high material intensity, stable asset custodianship, and existing return loops (e.g., infrastructure refurbishments). Thus, simpler, closed-loop systems (e.g., copper cables in power grids) were viewed as more

suitable for MaaS pilots. These use cases involve large material volumes, minimal ownership transfers, and clearer logistics.

- *Copper cables* were identified as a mixed case: technically feasible for pilots, but at risk of downcycling and theft, especially in geographies with weak enforcement.

Value from Stock, Not Just Flow

- *Unlocking value from the world's material stock:* Participants shared that a significant portion of the world's material stock (estimated at $150–200 trillion) is designed to become waste. MaaS reframes this as a latent asset base. Hence, stakeholders were urged to consider MaaS not just as a sustainability strategy, but as a *business innovation* that could unlock value from underutilised assets, provided there's a financial architecture that recognises material in-use as an investable asset class.

- *Business models around stocks:* Despite this reality, participants highlighted that traditional business models in metals are built around *flows*—selling into the market and recovering through recycling. However, MaaS should fundamentally be about extracting value from *stocks*—materials embedded in products and infrastructure over long timeframes. Participants highlighted the need to move away from simplistic "leasing metals" models and instead understand the importance of building and managing a material stock—similar to a housing stock—for metals.

- *Picking the right benchmark to evidence value:* When discussing the paradigm change of extracting metal's value from stock, participants raised the importance of selecting an appropriate benchmark against which to evaluate MaaS, underscoring how people often incorrectly compare stock-based models (long-term rentals, asset-in-use) with flow-based models (one-time sales). This leads to skewed evaluations that make the new model look financially unviable. Participants mentioned the need to prove that this new model provides either equal or better value than selling.

- *Urban mining data:* The concept of urban mining, viewing cities as repositories of future material stock, was highlighted as a critical area for development. Participants noted that while extensive geological data exists on natural resource stocks, there is a significant lack of equivalent data for the urban environment. This underscores the need for systematic mapping exercises to quantify urban material stocks, for example, copper embedded in London's building infrastructure, which would empower companies to innovate competitively around recovery, pricing, and service offerings.

Policy, Legal, and Governance Enablers

MaaS will need enabling policy, legal, and institutional frameworks:

- *Contractual Innovation:* Examples from housing (e.g., leasehold vs. freehold) and mining joint ventures were used to emphasise that *fluid, shared, or time-bound ownership structures are not new*—they just need adaptation to materials. Legal systems must recognise and enforce *layered or conditional ownership* (e.g., metals embedded in buildings), without creating resale friction or title confusion.

- *Policy Action:* Extended producer responsibility (EPR), regulatory clarity, and procurement standards will be key to supporting MaaS adoption. The need for waste regulation to be updated and have MaaS considered in the design phase of new products was identified by participants. Some actors expressed that policy should support pilots over perfection: "Don't wait for platinum-ready models."

- *Traceability:* There was a debate around the importance of traceability in a MaaS model, in particular in the context of long value chains. There was discussion of digital systems that allow tracking and transfer of circular ownership rights and the circularity clause. Traceability tools like battery passports, blockchain, and material registries appear as helpful for tracking ownership, while QR codes and digital twins generally enable tracking material flows and metal performance. However, concerns were raised about the costs and practicality versus the value of these methods of achieving traceability, and policy intervention might be necessary to enable industry uptake.

- *Geopolitical Alignment:* Participants raised concerns about China's market concentration of metals processing and suggested that to succeed globally, MaaS must integrate with dominant players like China. In response, the Carbon Trust and CCSI teams urged caution, noting that while the issue warrants further research, it may not yet constitute a barrier. All participants agreed that positioning MaaS as aligned with national industrial and economic goals may help generate broader political support. MaaS may gain support if it is framed as part of *industrial and supply chain resilience*, rather than only as an environmental tool.

Economic and Financial Enablers

Economic and financial incentives will play a large role in supporting actors across the value chain to perceive an economic value added in implementing it:

- *Economic incentives:* It was expressed that there is a need to map the subsidies and other economic incentives currently available that could be applied to a MaaS business model, and identify how they could be used in practice. The discussion also highlighted the importance of identifying additional economic or financial enablers that may need to be developed to fully realise the potential of MaaS.

- *Co-location and regional hubs:* Similarly, it was identified that logistics (e.g. taxes, tariffs, and transport costs) pose practical hurdles, especially when reused materials cross borders. The feasibility of return loops might depend on co-locating fabrication, refurbishment, and reuse—without which MaaS might become environmentally or financially inefficient. Battery and cable examples show that design for disassembly and regional recovery hubs will be critical to avoid value leakage.

- *Special purpose vehicles (SPVs):* There was a discussion around the implementation of SPVs as financial enablers of the MaaS business model by diversifying risks, concentrating knowledge, and enabling metal producers to derecognise assets. However, concerns were raised about the added complexity they would bring about if introduced too early in the development of a MaaS model. A suggestion was made to

identify preparatory steps—such as building trust, aligning objectives, and testing collaboration mechanisms—before proposing the creation of an SPV. Doing so would help ensure that, when the time comes, the SPV feels like a natural and value-adding next step rather than a burdensome requirement.

- *Green premiums:* There was skepticism about green premiums; several participants expressed that relying on customers to pay more because a material is greener is not a sustainable business model, and long-term success depends on cost competitiveness, not higher prices justified by sustainability alone. Instead, an alternative framing was suggested where the focus should be on risk transfer and value-added services that justify a higher price. In this case, charging for actual risk-taking (e.g, holding ownership or performance obligations) is a value proposition, in the form of avoided price volatility risk.

- *Innovative finance:* Participants identified the need to create innovative and purpose-built financial instruments that facilitate asset return, ownership tracking, and long-term value capture. Historical precedents like car leasing and housing mortgages were discussed as analogs that could inspire new financial instruments for MaaS, as they have managed ownership and enabled long-term value creation in material stocks through predictable cash flow, risk-sharing, and asset return mechanisms, when the asset does not depreciate in value. Similarly, if MaaS is to be applied to durable products with investment horizons of 10–15 years or more, where long-term commitments are often difficult, there is a clear need for innovative financing approaches. These could draw inspiration from existing models used for high-value, long-lived assets such as aircraft, leveraging refinancing mechanisms and liquidity solutions already present in the market.

- *Insurance:* The role of insurance in underwriting long-term risk was raised by participants and actively debated. Participants noted that insurers could serve as de-risking instruments, but only if they offer long-horizon products. Some also suggested that, beyond risk protection, insurers could possibly evolve into long-term financiers for MaaS-related infrastructure and assets, as traditional banks avoid MaaS due to risk and lack of track record. For insurers managing long-term liabilities, MaaS-linked leases (e.g., of copper in cables) could match their investment horizons and offer inflation-protected returns, positioning them as potential silent financiers rather than just risk-bearers. Reacting to this discussion, the Carbon Trust and CCSI team suggested how patient capital (e.g., pension funds) could play a role in providing financial instruments suited for MaaS.

Next Steps and Strategic Framing Going Forward

The workshop concluded with a strong sense of momentum and shared purpose. Participants acknowledged that while variants of MaaS or related servitisation models are already emerging or nearing implementation, a single MaaS model spanning the entire critical minerals value chain is unlikely to be viable. Instead, there was consensus around focusing efforts on shorter, commercially promising value chain segments, where MaaS models could take root.

The discussion also revealed the need for greater conceptual clarity around MaaS—particularly distinguishing it from recycling—and for clearly articulating the roles of different stakeholders (e.g., owner, user, financier), the specific problems MaaS aims to solve (e.g., decarbonisation, supply security, circularity), and the metrics by which value is delivered (e.g., carbon savings, investor returns, reduced virgin extraction). CCSI and the Carbon Trust are committed to addressing these gaps in future research, including exploring tools to clarify how value should be measured and to articulate the new markets and benefits that MaaS can unlock.

Participants were encouraged to "suspend reality" and imagine new systems, drawing on past examples of systemic change. They showed enthusiasm for innovative business models—provided these could establish clear commercial viability for all involved. Interest in MaaS extended beyond the room, with several organisations that could not attend expressing a desire to stay involved and learn more as the project evolves. Building on this, participants proposed a second, collaborative workshop in October 2025 to co-develop business models based on real-world examples, inviting underrepresented segments of the value chain to join the effort. Planning is underway for this second iteration, which will be informed by your feedback on the July workshop and your preferences on the format (in-person, online, or hybrid) and availability.

Contact us

If you have any feedback, questions, or concerns regarding the content above, please feel free to contact us using the details below.

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