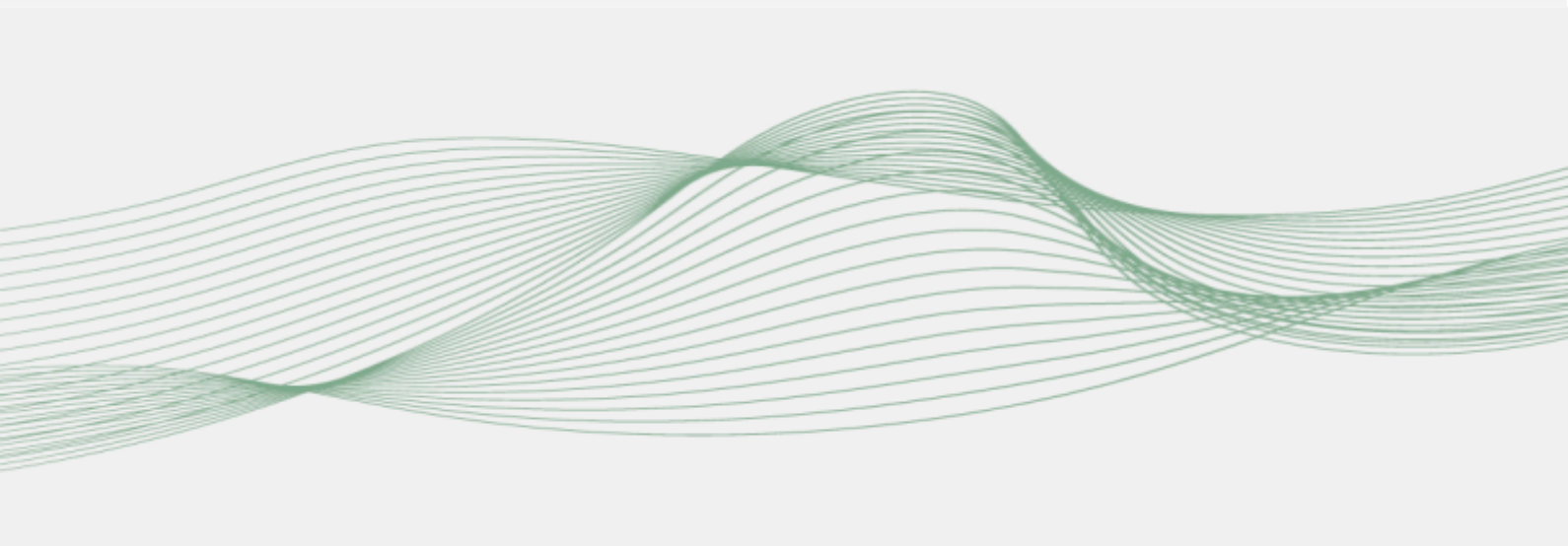




Blockchain & AI Traceability Pilot for the Renewable Energy Sector

Phase 1 Final Report



Prepared for:
International RBC Agreement for
the Renewable Energy Sector

Prepared by:
Minespider GmbH & Responsible Trade LLC

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List of Abbreviations & Definitions

Abbreviation	Explanation
AI	Artificial Intelligence
API	Application Programming Interface
ASI	Aluminium Stewardship Initiative
CoC	Chain of Custody
DPP	Digital Product Passports
ERP	Enterprise Resource Planning
ESG	Environmental, Social and Governance
ESPR	Ecodesign for Sustainable Products Regulation
GmbH	Gesellschaft mit beschränkter Haftung — German limited liability company
IRBC	International Responsible Business Conduct
KPI	Key Performance Indicator
LLC	Limited Liability Company
LME	London Metal Exchange
MS	Minespider
NDA	Non-Disclosure Agreement
NGO	Non-Governmental Organization
OECD	Organisation for Economic Co-operation and Development
PC; PCX-TX	Pilot Company; Pilot Company X – Tier X
PM	Project Management
PO	Purchase Order
PT	Project Team = MS and RT
EPT	Extended PT = PT + SER + PCs
RMI	Responsible Minerals Initiative
RT	Responsible Trade

SER	Social and Economic Council of the Netherlands
SMRT	Supplier Mapping Reporting Template
Tier 0	Pilot company or focal downstream company whose selected in-scope product forms the starting point for supply chain mapping.
Tier-1	Direct supplier to Tier 0 for the in-scope product, component or material.
Tier-2	Supplier to a Tier-1 supplier associated with the in-scope product, component or material.
Tier-3	Supplier to a Tier-2 supplier further upstream in the in-scope supply chain.
Upstream Target Nodes (Tier-3+)	Any supplier upstream of Tier-3

1. Executive Summary

This final report presents the results of Phase 1 of the IRBC Agreement for the Renewable Energy Sector's Blockchain & AI Traceability Pilot, commissioned by the Social and Economic Council of the Netherlands (SER) and delivered by Minespider GmbH and Responsible Trade LLC. The pilot assessed the feasibility of mapping aluminium and bauxite supply chains, collecting Environmental, Social and Governance (ESG) information and using Digital Product Passports (DPPs), blockchain and Artificial Intelligence (AI) to support supply-chain transparency across a wind-turbine component route and a cable-manufacturer route. Phase 1 began in February 2026 and was completed in August 2026. Phase 2 will not proceed, and this report therefore closes the project after Phase 1.

Methodology

The project used a mapping-first, OECD-aligned methodology combining buyer-led supplier engagement, the Supplier Mapping Reporting Tool (SMRT) developed for the pilot, supplier discussions, supporting documentation, targeted public-source research and evidence-status classification. ESG questions were integrated into the SMRT, while DPP demonstrations were introduced progressively and did not form a prerequisite for supplier participation.

Mapping results and geographic coverage

Mapping began with the two European pilot companies and progressed through their direct suppliers and identified upstream actors. Across both pilots, four Tier-1 pathways progressed into active participation: three pathways involving component-manufacturers and fabricators for PC1, represented by PC1-T1 A, PC1-T1 B and PC1-T1 C, and one pathway for PC2, represented by the supplier PC2-T1 A. The initially preferred PC1-T1 D supplier and PC2-T1 D declined to participate, while PC2-T1 B and PC2-T1 C did not progress into active participation during Phase 1. The active Tier-1 actors were located in Europe and Asia and provided information through the SMRT, discussions and supporting documentation at different levels of completeness.

The active pathways enabled ten Tier-2 actors to be identified across the two pilots. Pilot 1 accounted for nine Tier-2 actors, mainly aluminium processors, distributors and material suppliers located in Europe and Asia - with one identified Tier-2 supplier confirming participation through PC1-T1 A. The remaining Pilot 1 Tier-2 actors were disclosed by PC1-T1 B and PC1-T1 C but were not directly engaged during Phase 1.

Pilot 2 contributed the deeper upstream route through PC2-T1 A, whose largely vertically integrated structure enabled aluminium-processing stages and facilities associated with bauxite, alumina, primary aluminium and aluminium wire rod to be identified and discussed. The cross-pilot mapping also identified one potential Tier-3 aluminium processor or casthouse in Australia and four upstream target nodes representing primary aluminium production, alumina refining and bauxite sourcing in Europe, and the Asia-Pacific region.

90% of the identified Pilot 2 pathway (not material volume) was associated with vertically integrated operations reviewed with the Tier-1. The remaining 10% involved third-party sourcing, for which information existed but supplier identities and sourcing relationships remained commercially sensitive and only partially validated. Pilot 1 therefore provided broader Tier-1 and Tier-2 coverage, while Pilot 2 achieved deeper preliminary visibility across smelting, refining and mining stages. The resulting maps distinguish supplier-confirmed information, public-source findings, inferred relationships and open validation gaps. To respect confidentiality, the report presents certain results by region and actor type rather than identifying individual facilities or companies.

ESG, DPP, blockchain and AI findings

ESG information was collected through the SMRT, supplier discussions, supporting documentation, public sustainability disclosures and certification information. Company-level information was generally more available at Tier-1 than product-specific or upstream ESG information. Pilot 2 provided a stronger screening-level baseline because the active supplier had established ESG governance, public reporting and a largely vertically integrated structure. Across both pilots, public and certification sources supported screening and supplier discussions but did not replace supplier-provided evidence. The information collected was therefore sufficient for screening and DPP familiarisation, but not for independently validated ESG conclusions regarding upstream actors.

DPPs provided a practical way to structure, connect and selectively share available mapping, ESG and evidence information. Reuse of SMRT data reduced duplicate requests, while tailored demonstrations helped participants understand possible chain-of-custody representations, visibility settings and developing ESPR requirements. Blockchain-supported records added integrity, versioning and auditability, and AI supported public-source research and data structuring. These technologies remained supporting tools: none independently verified supplier declarations or physical material flows, and AI-assisted findings required source review and human validation.

Why Traceability Became More Difficult Upstream

The principal barrier was not the technical ability to create a DPP or digital record. Progress became more difficult beyond Tier-1 because the direct commercial relationship weakened, reducing the leverage available to the pilot companies and project team. Tier-1 contacts often needed internal procurement or management approval before disclosing upstream actors or facilitating introductions. Fragmented supply chains involved multiple independent processors, traders, smelters, refiners and sourcing routes that could also change over time, reducing the downstream customer's visibility.

Commercial sensitivity created a further constraint. Supplier identities, production relationships and sourcing routes could be known internally while remaining unavailable for downstream disclosure. Supporting evidence was also uneven, and public information or certification records could identify plausible facilities without demonstrating that they supplied the specific product or material flow being mapped. Supplier disclosure and desktop research therefore supported identification, but did not by themselves constitute validation of a product-specific chain of custody.

Business Expectations, Escalation and Confidentiality Measures

Phase 1 applied active buyer support rather than relying solely on project-team outreach. In practice, a clear business expectation meant that the participation request was supported by the pilot company, owned by the relevant procurement or commercial relationship contact, accompanied by a defined response expectation and followed up where the initial request did not progress. The escalation process moved from operational reminders to the relevant relationship owner or procurement contact. This approach improved engagement, although participation remained voluntary throughout the pilot.

The project also applied proportionate confidentiality measures. Suppliers were informed that the pilot did not request pricing, volumes, contract terms, supplier-performance information or audit judgements. Requests were limited to the in-scope product, facility and supplier role. NDA and joinder-NDA options, public, transparent and private visibility layers, controlled sharing and anonymised entries were used or demonstrated where relevant. These measures supported selective disclosure but could not remove every barrier, particularly where an upstream source was known to a supplier but could not be disclosed downstream.

Scalability and future application

The methodology is replicable because its core sequence buyer-led engagement, structured mapping, ESG collection, targeted research, evidence classification, validation and DPP-based information structuring, is not specific to aluminium. Future application to copper, battery raw materials, steel and other metals, renewable-energy equipment or electronics would require adjustment of the SMRT, ESG questions, terminology, certification sources and DPP data fields, but not a fundamental redesign of the engagement and validation process. The approach can also accommodate suppliers with different levels of digital maturity because participation can begin through existing documentation, questionnaires and clarification discussions without requiring immediate platform adoption.

For wider application across IRBC Agreement companies, a minimum dataset should be standardised before outreach: actor and facility role, country or region at the agreed disclosure level, material or product relationship, evidence source, validation status, core ESG fields and confidentiality classification. Supplier, facility, material or DPP records could be reused where the data owner authorises sharing, while product-specific links and restricted fields remain under controlled access. Common definitions, evidence labels, ownership rules, visibility settings and update processes, together with shared engagement materials, translations and escalation guidance, would reduce repeated effort and support scalability.

Future initiatives should prioritise deeper validation of established pathways and direct engagement with the most relevant Tier-2 and upstream actors. They should retain the mapping-first approach, active buyer sponsorship, progressive information requests, evidence-status labelling, proportionate confidentiality controls and structured escalation applied during Phase 1.

Conclusion

The IRBC Agreement Blockchain & AI Traceability Pilot Phase 1 partially mapped aluminium and bauxite supply chains for two pilot companies, demonstrating the practical application of Digital Product Passports (DPPs), blockchain, and AI for supply chain transparency. The project achieved significant stakeholder engagement, identified multiple supply chain actors, and collected ESG data, though data completeness and validation became more challenging further upstream due to supplier participation and commercial sensitivities.

DPPs and blockchain were technically feasible and provided practical value for structuring, maintaining and auditing traceability information.

The project concludes after Phase 1, offering actionable recommendations for future initiatives: prioritise validation of existing pathways, strengthen supplier engagement, focus on evidence-backed ESG data, and align with evolving regulatory requirements to enhance digital traceability in the renewable energy sector.

2. Introduction & Project Context

2.1 Project Background

The **Blockchain & AI Traceability Pilot for the Renewable Energy Sector** was commissioned by the Social and Economic Council of the Netherlands (SER) under the International Responsible Business Conduct (IRBC) Agreement for the Renewable Energy Sector.

This pilot was formally initiated in February 2026 and was originally structured around a two-phase delivery approach. Phase 1 was completed in August 2026. Phase 2 was intended to last from September to December 2026. As Phase 1 answered the main questions about applicability, success factors and scalability of blockchain and AI technology in aluminium supply chain traceability, the project will not proceed to Phase 2. This final report summarises the work completed, results achieved, limitations identified, lessons learned and recommendations.

The pilot assessed the feasibility of mapping aluminium and bauxite supply chains in the renewable energy sector and explored usage of Digital Product Passports (DPPs), blockchain and AI to improve supply chain transparency in line with OECD due diligence expectations.

The project is delivered by Minespider GmbH (Lead Contractor) and Responsible Trade LLC.

2.2 Scope of the Assignment

The assignment covers two aluminium containing pilot supply chains: a wind turbine component route and a cable manufacturer route. The emphasis was on mapping upstream actors, evidence status, ESG information availability and feasibility of digital traceability.

For this purpose two Pilot Companies (PCs) were chosen as the starting point for the two pilot supply chains and are identified as PC1 and PC2.

The scope of the project focuses on:

- **Mapping the selected supply chains for aluminium** from the PC to their upstream supplier levels, with the objective of reaching the mine of origin where feasible. The original scope was to identify one preferred Tier-1 supplier and look at their sub-tier supply chain. Due to lack of participation from some Tier-1 suppliers the scope to multiple Tier-1 suppliers was increased for the pilot companies.
- **Collecting and documenting ESG-related information** across each level of the supply chain.
- **Assessing the feasibility of digital traceability solutions**, including DPPs, AI and blockchain technology, to support supply chain transparency and traceability.

Through these activities, the project aimed to evaluate the practical applicability, challenges, and scalability of digital traceability approaches within complex mineral supply chains such as aluminium in the renewable energy sector.

2.3 Objectives & Deliverables of Phase 1

Phase 1 of the project was designed to establish the foundations for supply chain mapping; stakeholder engagement; Environment, Social, and Governance (ESG) data collection; and digital traceability assessment across the two pilot supply chains.

In accordance with the signed Public Service Contract and the approved project proposal, Phase 1 provided an evidence-based assessment of the methodologies applied, progress and results achieved, challenges encountered and conclusions from the activities.

Particular attention was also given to assessing the feasibility of blockchain and Artificial Intelligence (AI) technologies, including the potential risks associated with the use of AI in the context of factually correct and commercially sensitive information.

The key Phase 1 deliverables were as follows:

1. Supply Chain Mapping and Traceability Report

- Detailed mapping of the selected aluminium and bauxite supply chains and their current level of traceability;
- Identification of gaps, limitations, and challenges impacting full upstream visibility;
- Recommendations for improving traceability outcomes;
- An initial assessment of the advantages and limitations of blockchain and AI technologies for supply chain traceability and their potential applicability to other sectors and minerals.

2. Stakeholder Engagement Summary

- Documentation of supplier onboarding and engagement activities;
- Summary of participating organizations and supplier interactions;

- Identification of challenges encountered during engagement activities;
- Lessons learned and recommendations for future scalability.

3. ESG Data Collection

- Collection and documentation of available ESG-related information for identified suppliers;
- Assessment of ESG data availability and quality across the supply chain;
- Development of a repeatable approach for future ESG data collection activities.

4. Blockchain and AI Feasibility Review

- Assessment of DPPs, blockchain technology, and AI applications in supporting supply chain transparency;
- Evaluation of the potential benefits and limitations of digital traceability approaches;
- Assessment of AI-related information security/quality considerations, particularly in relation to commercially sensitive information;
- Recommendations regarding the future applicability and scalability of these technologies within the renewable energy sector

3. Methodology & Approach

3.1 Overall Delivery Approach

The project was delivered using an OECD-aligned due diligence approach, combining supply chain mapping, stakeholder engagement, ESG data collection, and digital traceability assessment across the two pilot supply chains.

Activities were implemented through a phased and iterative methodology, supported by established project governance, defined roles and responsibilities, terminology, escalation process, and a dedicated project documentation and tracking framework. This included pilot-specific workspaces, meeting and document logs, stakeholder contact tracking, and version control mechanisms to support consistency and auditability throughout the project.

The pilot project was designed as a point-in-time supply chain mapping exercise, providing a snapshot of supply chain relationships rather than a transactional traceability system. This event-based approach allowed the Project Team (PT) to test and evaluate the mapping tools while minimizing the burden on suppliers. Transaction-level traceability requires the continuous capture of material flow data and integration with supplier systems. As such, the pilot mapping exercise should be viewed as an important first step toward future traceability rather than a transactional traceability solution itself.

The work was delivered as a dual-track approach: (i) supply chain mapping using Supplier Mapping Reporting Tool (SMRT) information, supplier outreach and aluminium-related public research; and (ii) access to the DPP platform, familiarization with it and sample

passports creation. These tracks are related but not identical; suppliers can support mapping without immediately joining the platform.

Phase 1 followed a step-by-step rollout consisting of:

- Identification of upstream actors and supply chain mapping
- Stakeholder engagement and supplier onboarding;
- Collection and assessment of ESG-related information;
- Implementation and evaluation of DPP capabilities and supporting technologies.

To facilitate supplier engagement and participation, the PT developed a set of supporting materials, including a Supplier Engagement plan and an Escalation plan as a starting point, followed by the SMRT and customised supplier onboarding presentations, pilot one-pagers, standardized communication templates, translation of materials and DPP customised samples for each pilot participant. Please refer to **Appendix A - Stakeholder engagement materials** for a more detailed overview.

3.2 Supply Chain Mapping Methodology

To begin the work a Supplier Engagement Plan was developed and laid out the approach and explicitly identified out of scope elements (pricing, volumes, contract terms, supplier performance, and audit or compliance judgements).

The following guiding principles were established to help define the process:

- Mapping before DPP – validate structure first, digitalize second.
- Engagement before documentation – secure buy-in before sending questionnaires.
- Proportionate data requests – limited to role and product scope.
- Layered disclosure – entity/mapping confirmation first, ESG depth later.
- Confidentiality - clarification to be provided, NDA to be considered.

A phased approach was developed to encourage participation and understanding of the pilot program. The following outlines this approach:

Phase 0 – Internal Preparation (Before Tier-1 Engagement)

- Confirm selected product reference with pilot companies
- Confirm selected Tier-1 supplier
- Conduct targeted public research (smelters, certifications, ESG disclosures).
- Develop draft **Supplier Mapping Reporting Template (SMRT)**, a structured questionnaire designed specifically for the pilot to collect supply chain and ESG information to support Due Diligence on aluminium-containing products.
- Refine SMRT
- Share SMRT with pilot companies and other stakeholders for feedback/alignment
- Prepare Tier-1 'Invitation to join pilot' one-pager document (no SMRT attached).

Phase 1 – Tier-1 Introduction (Relationship-Based)

- Introduction email sent by relationship owner/pilot company (e.g., PC1 or PC2).
- Attach 'Invitation to join pilot' one-pager document only (no SMRT).
- Clarify: limited scope, not an audit, no commercial data requested.
- Propose 45–60 minute alignment call (confirm participant, from PM team, and pilot company)

Phase 2 – Tier-1 Mapping Alignment Call (45–60 mins)

- Brief project explanation & cascading engagement approach.
- Walk through the supplier mapping reporting template (SMRT) and process.
- Clarify AI role (data structuring support, not mapping engine).
- Confirm product and upstream production entity (smelter/refinery).
- Understand sourcing structure (single vs multiple sources).
- Agree on Tier-2 introduction pathway.
- Outline next steps and timeline (SMRT sent over email, Minespider platform onboarding, DPP structure).

Phase 3 – Targeted SMRT (After Call)

- Send the SMRT within 24 hours after the call.
- Focus on: supply chain mapping, ESG and Digital Product Passport (DPP) data.
- High level ESG check/evaluation.
- Provide a 2-week response window.
- Offer a short clarification call if needed.

Phase 4 – Tier-2 Cascading Engagement

- Follow the same structured approach with lighter messaging with introduction coming from Tier-1.
- Adapt communication tone 'Invitation to join pilot' one pager document based on geography/sensitivity.
- Focus on entity confirmation and mapping before ESG and DPP.
- Maintain appropriate level of engagement.

Phase 5 – DPP Structuring (Post-Mapping Validation)

- Structure validated mapping information initially in Excel to confirm logic, tier relationships, and product attribution.
- DPP examples will be created only after mapping coherence is confirmed.
- Platform onboarding is handled as a separate, opt-in phase.

Once the process was defined and the draft SMRT was completed, the mapping process began. Supply chain mapping activities were conducted using a tier-by-tier approach, beginning with the participating pilot companies and progressing upstream through their respective supplier networks.

The **Supplier Mapping Reporting Template (SMRT)** was developed by the PT as a structured questionnaire designed specifically for the pilot to collect supply chain, ESG, and due diligence information for aluminium-containing products. While similar in structure to the Responsible Minerals Initiative (RMI's) Conflict Minerals Reporting Template which only maps to smelters or refiners with no mid-tier information collected, the SMRT is collecting sub-tier specific information to map each level of the supply chain all the way past the smelter or refiner to the mine site. Including location of facility and specific products produced as if it relates to the Aluminium supply chain.

The SMRT was designed to:

- Improve supply chain transparency;
- Support responsible sourcing aligned with the OECD Due Diligence Guidance;
- Enable creation of sample DPPs and regulatory requirements familiarization;
- Minimize supplier burden by collecting only information relevant to the in-scope product and mineral.

The SMRT consists of four sections:

- Sheet 1: Project introduction and context;
- Sheet 2: Definitions and terminology;
- Sheet 3: Supply chain mapping information, including materials, facilities, suppliers, and roles (type of supplier, i.e. Downstream Supplier, Trader, Processor, etc.);
- Sheet 4: Existing documentation, systems, and ESG/due diligence information.

For a full overview of the SMRT please refer to **Appendix A - Stakeholder engagement materials**.

Mapping activities were supported through:

- Standardized supplier questionnaires (SMRT);
- Direct stakeholder engagement and follow-up interviews;
- Review of supporting documentation and publicly available information;
- Validation and consolidation of findings within the project workspaces and DPPs.

Particular emphasis was placed on identifying critical upstream nodes, including smelters, refiners, and mines of origin where feasible.

Consistent with OECD due diligence principles, the mapping outputs are a point-in-time snapshot based on information reasonably available at the time of reporting, and not a transactional chain-of-custody record. This is due to the dynamic nature of supply chains, especially as you go further upstream as sub-tier suppliers may change with little to no visibility to the downstream customer.

Mapping should also use validation labels: supplier-confirmed, desktop research, inferred/probable or open. Several activities combined ASI certificates, public sources and AI-assisted research, so the report will not present them as confirmed transactional flow unless supplier confirmation is obtained.

3.3 ESG Data Collection Methodology

ESG data collection was conducted alongside the supply chain mapping activities using a standardized questionnaire integrated into the SMRT. The objective was to establish a consistent and repeatable approach for collecting ESG-related information across identified supply chain participants.

The ESG assessment focused on three principal areas:

- Human rights and labour practices;
- Environmental impacts and management;
- Governance structures and responsible business conduct.

Where available, supporting documentation and publicly accessible information were also considered to complement supplier responses.

ESG information should be treated as contextual screening unless supported by company-specific evidence. Country-level risk layers, ASI certification and potential third-party data such as EcoVadis data can support risk context but should not be presented as supplier findings without verification.

The purpose of the ESG data collection activities was not to perform a formal supplier assessment or audit, but rather to evaluate the availability and consistency of ESG information and establish a methodology that may be replicated across future supply chains within the IRBC Agreement.

3.4 DPP Platform & Traceability Methodology

The Minespider platform was applied as the digital identification layer of the pilot to assess how information obtained through supply chain mapping and ESG data collection could be structured, linked and selectively shared through Digital Product Passports (DPPs). The methodology consisted of translating available pilot data into structured digital records and establishing relationships between relevant entities, products, materials, supply chain information and associated ESG data.

As part of the pilot, all participants were offered access to the platform and onboarding. The onboarding and testing process covered:

- Account and company setup;
- Passport creation through manual entry, batch import, Application Programming Interface (API) and AI-assisted data population;
- Data visibility and sharing controls;
- Mapping linking; and
- Blockchain-supported version records.

Sample passports and customised demonstrations were developed based on the pilot context to familiarise participants with the DPP concept and assess how available supply chain information could be represented digitally. For the scale and data availability of Phase

1, manual entry, batch import and the Minespider AI 'Copilot'-assisted passport creation were considered sufficient for pilot testing, while API integration represents a potential future option for higher-volume implementation.

The methodology also considered the emerging relevance of DPPs under the **Ecodesign for Sustainable Products Regulation (ESPR)**. While aluminium-specific DPP requirements are still evolving (expected end of 2027), the pilot provides a practical environment for the participants to assess how aluminium provenance, supply chain and ESG information could be structured to support future product-level digital information requirements. To this end it is important to understand how other programs or initiatives such as ASI and LME are developing their ESG requirements.

In this pilot, the DPP is used as a point-in-time supply chain mapping exercise, as described in Section 3.1, rather than as a transactional traceability system tracking individual shipments over time.

The reliability of the information remains dependent on its underlying source and validation status, offering the ability to distinguish supplier-confirmed information from desktop research, inferred or probable relationships, and identified data gaps.

3.5 Blockchain & AI Approach

Blockchain and Artificial Intelligence (AI) tools were assessed as supporting technologies within the digital traceability/mapping approach, with a focus on their practical application, benefits and limitations.

Blockchain supports the integrity and auditability of information recorded within the DPP environment by providing tamper-evident records, versioning and change tracking. This creates a reliable record of how information evolves over time, while not independently verifying the accuracy of the original supplier-provided data.

AI was explored as a supporting tool to improve the efficiency of working with supply chain information, including information extraction and structuring, translation, comparison and identification of potential data gaps using publicly available information and sources as well as for translation of materials, where required.

The Minespider AI 'Copilot' was also used to demonstrate AI-assisted population of DPP information. AI-generated outputs are treated as assisted inputs rather than verified facts and require human review before being used in mapping, DPPs or project outputs.

Given the potential sensitivity of supply chain information, particular attention was also given to factual accuracy, human validation and the appropriate handling of information when using AI-enabled tools.

4. Pilot 1 (PC1)

4.1 Pilot Overview

Pilot 1 focused on tracing aluminium used in selected wind turbine components within the PC1 supply chain, with platform related aluminium items selected as the in-scope component.

The pilot applied a downstream-to-upstream approach, starting with PC1 and its direct suppliers and progressively seeking to identify relevant aluminium processors, smelters/refiners and, where feasible, mines of origin. Phase 1 was designed as a feasibility and partial-mapping phase, testing how far upstream visibility can be achieved through supplier engagement, structured data collection and digital traceability.

During implementation, PC1 and the project team expanded engagement to multiple Tier-1 suppliers to strengthen the feasibility assessment and reduce reliance on a single pathway.

Phase 1 established supplier pathways, collected available product and supply-chain information and assessed the conditions required for deeper upstream traceability. Supplier engagement and mapping results are presented in **Sections 4.2** and **Section 4.3** and **Appendix B – Preliminary Supply Chain Maps**.

4.2 Supply Chain Engagement Summary

Supply chain engagement followed the **cascading methodology described in Section 3.2**, with PC1 leading introductions to its preferred direct suppliers and participating Tier-1 suppliers being asked to facilitate engagement with their relevant upstream actors (i.e. Tier-2 suppliers).

After the initially preferred Tier-1 supplier declined to participate, PC1 and the project team expanded outreach to additional suppliers in parallel. This resulted in three active Tier-1 pathways and reduced reliance on a single supplier route.

Minespider and Responsible Trade supported engagement through the SMRT, pilot information materials, translated content, clarification calls and tailored DPP demonstrations. Confidentiality concerns were addressed through clarification, controlled information sharing and NDA options, including a joinder NDA developed by PC1.

Participant	Response & Participation	Information/Support provided	Upstream engagement	Current Assessment
PC1	Active	Internal coordination, supplier selection, introductions and support.	Supporting Tier-1 and upstream engagement.	Strong involvement; continued support from buyer and procurement functions remained important for upstream progression.

PC1-T1 A	Active	SMRT, translated materials, additional materials, direct discussions, onboarding and tailored DPP support and platform access enabled/NDA offered.	Tier-2 preferred supplier identified and confirmed participation.	Strong active pathway. Supplier has provided SMRT input, engaged through translated/support materials and platform onboarding, and identified a preferred Tier-2 supplier with participation confirmed.
PC1-T1 B	Active	SMRT, pilot one-pager, direct discussions, onboarding, tailored DPP support and platform access enabled/NDA offered.	Tier-2 suppliers identified and shared. Participation and further engagement remained pending at the end of Phase 1, subject to final feedback from the procurement team.	Active and responsive Tier-1 pathway with relevant Tier-2 suppliers identified and shared. Further progress depended on final procurement feedback and willingness to facilitate introductions. NDA/controlled disclosure was needed to address confidentiality concerns.
PC1-T1 C	Active	SMRT, pilot one-pager, direct discussions, onboarding/NDA offered.	Tier-2 suppliers identified and shared. Participation and further engagement remained pending at the end of Phase 1, subject to final feedback from the procurement team.	Active Tier-1 pathway with initial supplier engagement completed and Tier-2 suppliers identified. Platform onboarding remained less advanced than for other active pathways and further participation depends on procurement feedback and confidentiality clarification.
PC1-T1 D	Declined participation	Initial outreach and participation request.	Not progressed	The first Tier-1 supplier invited by PC1. Its decision not to participate demonstrated the risk of relying on a single supplier pathway.

Table 1: Pilot 1 engagement status at end of Phase 1

The approach established three active Tier-1 pathways. Several practical learnings have emerged from Phase 1:

- Active buyer and procurement support is important for supplier participation and upstream introductions.
- Parallel pathways reduce dependency on individual supplier responses.
- Proportionate requests, tailored materials and translations support engagement.
- Defined escalation routes and cross-functional ownership should be established from the outset.

Detailed engagement records and supplier-facing materials are included in **Appendix A – Stakeholder Engagement Materials**, while the resulting traceability and mapping status is presented in **Appendix B – Preliminary Supply Chain Maps**.

4.3 Supply Chain Mapping Progress

Mapping activities combined supplier engagement, completion of the SMRT, review of supporting documentation, clarification meetings and targeted desktop research. The objective was to identify relevant upstream actors associated with the selected wind turbine component and progressively improve visibility beyond Tier-1.

All three active Tier-1 suppliers provided information about their upstream supply chains through the SMRT. Although the level of detail varied, each supplier identified relevant Tier-2 actors associated with the aluminium used in the in-scope products. This demonstrated that the methodology could identify upstream actors before direct engagement with subsequent tiers.

The most advanced pathway was PC1-T1 A, through which one identified Tier-2 supplier confirmed participation. PC1-T1 B and PC1-T1 C disclosed eight additional Tier-2 suppliers through the SMRT and subsequent discussions. Direct introductions and participation did not progress for these suppliers during Phase 1, but the information provided enabled preliminary upstream pathways to be incorporated into the mapping exercise.

The mapping status achieved by the end of Phase 1 can be summarised as follows:

- Three active Tier-1 supplier pathways established.
- Nine Tier-2 suppliers identified across all three active Tier-1 pathways.
- One identified Tier-2 supplier has confirmed participation.
- Preliminary upstream supply chain maps have been developed using supplier information, supporting documentation and desktop research.
- Further validation and supplier engagement are required before identified relationships can be classified as fully confirmed.

The resulting pathways and evidence status are presented in **Appendix B - Preliminary Supply Chain Maps**. The maps distinguish between supplier-confirmed information, identified upstream actors, desktop-research findings and relationships requiring further validation.

The results also confirmed that active buyer sponsorship and procurement-supported engagement improve participation. Future initiatives should establish clear buyer

expectations and escalation routes from the outset, particularly beyond Tier-1 where downstream leverage is lower.

4.4 DPP & Traceability Implementation

Phase 1 reinforced a mapping-first approach, with the primary objective being to establish greater visibility into the supply chain and the origin of aluminium used in the selected products. Information in the DPP was therefore intended to be progressively incorporated as product, supplier, and upstream relationships were identified and validated.

To reduce the effort required from participating suppliers, Minespider used information already provided through the SMRT to prepare tailored sample passports in advance. The pilot DPP examples linked Tier-1 suppliers with relevant component-level data and demonstrated how information already collected through the mapping exercise could be reused rather than entered again. Where account setup was still pending, sample passports were prepared in advance and transferred or made accessible once the supplier account was activated.

The demonstrations presented passport-creation options suited to different levels of digital maturity, including manual creation, batch import and API-based integration. Combined with pre-prepared sample passports, these options provided a lower-effort entry point for suppliers. The platform demonstrated how mapped actors and information could be connected and, where relevant data were available, represented at product, batch or shipment level. Continuous transactional tracking was not demonstrated during Phase 1.

The platform's public, transparent and private visibility settings were demonstrated as a way to manage confidentiality and selectively share information with intended recipients. The DPP was therefore tested both as a means of structuring and communicating traceability information and as an engagement mechanism, helping suppliers understand how mapping information can be structured, reused and shared, while also providing practical context for developing ESPR and DPP requirements. Representative passport examples and platform screenshots are included in **Appendix C - DPP Platform Examples & Screenshots**.

The table below summarises platform engagement and implementation status at the end of Phase 1 (note: PC refers to the Pilot Company; T refers to supplier Tier of the PC and A, B and C refer to the three Tier-1 suppliers).

Company	Platform invite sent	Invite Accepted	Onboarding materials shared	Tailored sample passport prepared	Dedicated onboarding / demo	Passport access enabled
PC1	✓	✓	✓	✓	✓	✓
PC1-T1 A	✓	✓	✓	✓	✓	✓
PC1-T1 B	✓	✓	✓	✓	✓	✓
PC1-T1 C	✓	No	-	✓	-	-

Table 2: Pilot 1 platform engagement and onboarding status at the end of Phase 1

4.5 ESG Data Collection Status

Phase 1 ESG data collection was conducted through the SMRT and supplemented, where available, by publicly available company information, ASI certification information and supporting documentation provided by participating suppliers.

PC1-T1 A

PC1-T1 A completed the SMRT and participated actively in follow-up discussions. The supplier demonstrated awareness of ESG topics and provided information regarding existing management systems, business practices and supplier engagement processes. The company was generally responsive to clarification requests and demonstrated willingness to discuss future ESG data collection requirements. However, as with most participants, limited upstream ESG information was available beyond its direct operations and immediate supply chain. Additional supporting documentation and validation would be required to substantiate several reported elements.

PC1-T1 B

PC1-T1 B demonstrated awareness of responsible sourcing and sustainability requirements and discussed relevant internal processes during engagement sessions. The supplier provided partial ESG-related information through the SMRT process and participated in clarification discussions. While a number of ESG-related processes appear to be in place, supporting evidence and structured documentation were not always available within the project timeline. Further engagement would be required to obtain more complete evidence and upstream ESG information.

PC1-T1 C

PC1-T1 C participated in discussions and provided initial information relevant to the pilot. However, ESG information remained more limited compared with the other active Tier-1 suppliers. Responses indicated that some information exists internally, but additional

follow-up would be required before conclusions can be drawn regarding the maturity of ESG processes or upstream ESG coverage.

Overall, the information collected was sufficient for screening-level assessment and DPP familiarisation, but not for validated company-specific ESG conclusions regarding upstream actors. The most significant evidence gaps remained beyond Tier-1.

4.6 Key Findings & Risks

Phase 1 has established a workable foundation for aluminium traceability/mapping within the PC1 supply chain. The experience confirms that the primary challenge is not the technical ability to structure traceability information, but obtaining and validating information progressively further upstream. As expected, engagement has been strongest at Tier-1, while the transition to Tier-2 depends increasingly on Tier-1 procurement support, willingness to facilitate introductions, confidentiality considerations and the reduced leverage of the downstream buyer.

Table 3 summarises the principal Phase 1 findings and risks.

Area	Key Phase 1 Findings and Risks
Supplier Engagement	Three active Tier-1 pathways were established. Moving from one to several pathways reduced dependency on individual supplier response and provided a broader feasibility test.
Upstream traceability	Nine Tier-2 suppliers were identified across the three active Tier-1 pathways. One Tier-2 supplier confirmed participation; direct engagement and validation did not progress for the remaining identified Tier-2 suppliers during Phase 1.
Buyer leverage and Escalation	Buyer engagement (PC1) supported Tier-1 participation, but direct PC1 leverage decreased further upstream. Operational contacts alone may not always be sufficient to unlock Tier-2 engagement.
Confidentiality	Some suppliers remained cautious about disclosing upstream relationships or specific information requested through the mapping process.
Data completeness & validation	Supplier submissions required several rounds of clarification and review for some points from the SMRT.
Engagement approach	Clear PC1 support, gradual requests, tailored materials and translated support, where relevant, helped facilitate participation, especially with suppliers based in Asia.
DPP & digital traceability	SMRT data could be reused to prepare tailored passports, reducing duplicate data entry. Supplier-specific demonstrations generated stronger engagement than generic platform presentations.
Regulatory relevance	Evolving ESPR and DPP requirements provided an additional engagement point and helped explain the longer-term relevance of

	structured traceability information.
Scalability	The approach was feasible at Tier-1, while deeper mapping required greater coordination because of reduced buyer leverage, supplier participation, confidentiality and evidence-validation constraints.

Table 3: Pilot 1 Key findings and risks - Phase 1

5. Pilot 2 (PC2)

5.1 Pilot Overview

Pilot 2 was conducted with Pilot Company 2 (PC2), a European manufacturer supplying cable solutions for energy and infrastructure applications. The pilot focused on tracing

aluminium used within selected cable products (Medium Voltage Power Cable), with the aim of progressively establishing visibility across the associated aluminium and bauxite supply chain.

The original project approach envisaged starting with one preferred Tier-1 supplier. To broaden the feasibility assessment and reduce dependency on a single supplier pathway, PC2, Minespider and Responsible Trade agreed to expand the engagement scope, with PC2 approaching four Tier-1 suppliers for participation. By the end of Phase 1, one supplier had actively participated, one had declined and two had not progressed into active participation. PC2 increased its support and scheduled in-person meetings with one of the non-participating suppliers for the end of August. Phase 1 mapping therefore progressed primarily through the active supplier pathway and focused on establishing the available upstream connections, assessing supporting evidence and testing how the resulting supply chain and ESG information could be represented through DPPs.

Supplier engagement is detailed in **Section 5.2**, with mapping progress and upstream visibility presented in **Section 5.3** and in **Appendix B – Preliminary Supply Chain Maps**.

5.2 Supply Chain Engagement Summary

Supply chain engagement followed the same cascading methodology described in Section 3.2. PC2 approached four Tier-1 suppliers to broaden the feasibility assessment and increase the likelihood of establishing a viable upstream pathway. Of the four suppliers approached, one agreed to participate actively, one declined and two had not progressed into active participation by the end of Phase 1.

Engagement with PC2 was constructive, with its sustainability and procurement teams supporting supplier outreach, mapping discussions and review of the developing supply chain visualisations. For the participating Tier-1 supplier (PC2-T1 A), engagement progressed through dedicated onboarding, SMRT-based information collection, follow-up discussions, mapping review and DPP/platform demonstrations. The supplier-facing

approach emphasised proportionate information requests, reuse of existing information and support with upstream introductions rather than requiring new reporting.

Participation was limited in breadth but substantive within the active pathway. Engagement with PC2-T1 A enabled the project to develop a detailed preliminary upstream picture and use mapping visualisations to review and clarify identified relationships.

Participant	Response & Participation	Information/Support provided	Upstream engagement	Current Assessment
PC2	Active	Internal coordination, supplier selection, introductions and support.	Supporting Tier-1 and upstream engagement	Strong involvement; continued support through buyer/procurement departments remained important for upstream progression.
PC2-T1 A	Active	SMRT, additional materials, direct discussions, onboarding and tailored DPP support and platform access enabled.	Upstream actors and facilities identified. Third-party sources (10%) were explored through AI-assisted desktop-based research using publicly available information.	Strongest active pathway. Third-party sourcing (the remaining 10%) remained partially validated and subject to disclosure constraints.
PC2-T1 B	No active participation	Initial outreach and follow-up.	Not progressed	No active pathway was established during Phase 1.
PC2-T1 C	No active participation	Initial outreach and follow-up; In -person meeting scheduled with the PC2 team.	Not progressed	No active pathway was established during Phase 1.
PC2-T1 D	Declined participation	Initial outreach and participation request.	Not progressed	Demonstrated dependency on supplier willingness and internal capacity.

Table 4: Pilot 2 engagement status at end of Phase 1

The engagement confirmed the importance of PC2's buyer and procurement support. Within the active pathway, mapping visualisations and DPP demonstrations supported the

discussion and review of upstream relationships. The evidence basis and validation status of the resulting pathways are addressed in Section 5.3.

Detailed engagement records and materials are included in **Appendix A – Stakeholder Engagement Materials**, while the resulting supply chain pathways are presented in **Section 5.3 and Appendix B – Preliminary Supply Chain Maps**.

5.3 Supply Chain Mapping Progress

PC2 benefited from the participation of a supplier with a largely vertically integrated supply chain. This enabled the project team to identify and discuss upstream facilities and potential material pathways with greater confidence than would normally be available through public information alone.

As part of the mapping process, Minespider, Responsible Trade and PC2 conducted desktop-based supply-chain research using publicly available company information, sustainability disclosures, certification information and other available sources. This research was used to develop preliminary upstream pathways and identify potential refining and mining locations associated with the supply chain. The resulting outputs were subsequently reviewed and discussed between PC2 and the participating supplier as part of the validation process. Desktop research findings were therefore used as supporting evidence rather than as independent confirmation of product-specific material flows.

The mapping exercise also demonstrated one of the principal objectives of the pilot: the ability to combine supplier engagement, structured questionnaires, desktop research and DPP technologies into a single evolving mapping process. Through iterative discussions, several initially assumed relationships were refined, clarified or removed, demonstrating the importance of supplier validation and review rather than relying solely on publicly available information.

At the end of Phase 1, the PC2 pathway represented the most advanced upstream visibility achieved within the project. Approximately 90% of the identified supply chain pathway was associated with vertically integrated operations that have been discussed with the supplier. The remaining portion involved third-party sourcing where information exists, but commercial sensitivity limited further disclosure to downstream parties. This distinction highlights an important finding of the pilot: visibility, validation and disclosure are not always equivalent concepts. Information may be known and partially validated by a supplier while still remaining commercially sensitive and unavailable for broader sharing.

The mapping status achieved by the end of Phase 1 can be summarised as follows:

- Tier-1 supplier engagement was completed for the active supplier pathway.
- Relevant smelting, refining and mining stages were identified and discussed.
- Desktop-research findings were reviewed with the supplier and partially validated.
- Part of the upstream sources remained commercially sensitive and subject to disclosure restrictions.
- Product-specific transactional traceability was not achieved.
- Further validation would be required before the identified relationships could be classified as fully confirmed.

5.4 DPP & Traceability Implementation

As with Pilot 1, DPP and platform activities were carried out in parallel with the PC2 mapping exercise to assess how the identified aluminium supply chain could be digitally structured and linked. For this purpose, PC2 was provided with a dedicated account for pilot activities with its suppliers, as well as an additional testing account to independently explore the platform and DPP capabilities.

PC2 has actively contributed feedback during the pilot, particularly regarding the visualisation of chain-of-custody relationships. Several suggestions were incorporated into platform development and are now available as features, including chain-of-custody visualisation export and map functionality. The intended use within the pilot is to structure information received from participating suppliers into DPPs and progressively link these records so that, as the mapping develops, the platform can reflect the upstream relationships associated with the relevant material flow. DPPs represent a point-in-time record of the available information and can also be created at shipment level, rather than independently establishing or verifying the underlying supply chain. Examples of linked records representing multiple supply-chain actors are included in **Appendix C – DPP Platform Examples and Screenshots**.

PC2-T1 A received dedicated onboarding covering DPP functionality and the platform's public, transparent and private visibility layers. The supplier showed consistent interest in the DPP approach and in developing ESPR-related data requirements, noting that DPP solutions had been explored internally but not implemented.

Using information already provided through the SMRT, Minespider prepared linked sample passports for bauxite, alumina, primary aluminium and aluminium wire rod. Three dedicated DPP discussions were completed, including a session on 27 August 2026 addressing how upstream sources could be represented within PC2-T1 A's vertically integrated structure.

The pilot demonstrated that mapping information could be reused for DPP creation. Visibility controls, labels and anonymised entries also enabled an upstream source and its role to be represented without disclosing its identity.

Company	Platform invite sent	Invite Accepted	Onboarding materials shared	Tailored sample passport prepared	Dedicated onboarding / demo	Passport access enabled
PC2	✓	✓	✓	✓	✓	✓
PC2-T1 A	✓	✓	✓	✓	✓	✓

Table 5: Pilot 2 platform engagement and onboarding status at the end of Phase 1

5.5 ESG Data Collection Status

ESG information was collected through the SMRT, supplier discussions, public sustainability disclosures and desktop research. The maturity and scale of PC2-T1 A provided a stronger screening-level baseline than was achieved in Pilot 1; however, the information did not constitute independently verified ESG performance data.

PC2-T1 A demonstrated established ESG governance, public sustainability reporting and familiarity with responsible-sourcing requirements.

An important finding is that vertically integrated structures also improve ESG visibility. Because many relevant upstream stages fall within related operations, company-level ESG information can be more readily associated with upstream refining, smelting and mining activities. However, this becomes significantly more challenging where third-party sourcing is involved.

For the portion of the identified pathway involving third-party sourcing, ESG information remained more limited and depended on supporting documentation and supplier disclosure.

Overall, mature sustainability systems, public disclosures and vertical integration supported stronger ESG visibility. The principal gap remained the validation of ESG information for externally sourced materials.

5.6 Key Findings & Risks

Phase 1 established that mapping depth depends on both supplier participation and supply-chain structure. PC2-T1 A's largely vertically integrated pathway enabled comparatively strong upstream visibility, while third-party sourcing introduced additional confidentiality and validation constraints.

The principal risks relate to validation and evidence quality. Supplier input, public sources, certification information and AI-assisted research can support the identification of upstream relationships but do not constitute product-specific traceability without appropriate confirmation. The same limitation applies to ESG information and sample DPP data. Table 6 summarises the principal findings and risks.

Area	Key Phase 1 Finding / Risk
Supplier engagement	One of four Tier-1 suppliers participated actively; one declined and two did not progress into active participation, although PC2 continued engagement.
Upstream traceability	The active PC2-T1 A pathway provided substantially greater upstream visibility than originally anticipated. Through supplier engagement, existing company information and desktop research, the PT identified refining, smelting and mining stages associated with the supply chain. Approximately 90% of the pathway is linked to vertically integrated operations, while the remaining portion involves third-party sourcing where disclosure is constrained by commercial sensitivity.

Buyer leverage & escalation	Support from PC2's sustainability and procurement teams enabled outreach and follow-up, but participation remained dependent on supplier willingness and responsiveness.
Confidentiality	For the ~10% third-party sourcing, elements identified through desktop research were discussed and partially validated with the supplier, but source identities remain commercially sensitive.
Data completeness & validation	Supplier input, public information, certification data and AI-assisted research provide different evidence levels and do not independently confirm product-specific material flows.
Engagement approach	Participation was moderate in breadth but substantive within the active pathway. Structured mapping visualisations, focused information requests and tailored follow-up supported deeper discussion.
DPP & digital traceability	Linked DPP examples demonstrate how bauxite, alumina, primary aluminium and wire rod can be represented across a digital chain of custody, including anonymised or selectively shared information.
Regulatory relevance	The active Tier-1 supplier (PC2-T1 A) showed recurring interest in DPP capabilities and developing ESPR-related data requirements, providing an additional engagement driver.
Scalability	The active Tier-1 supplier (PC2-T1 A) indicated that vertically integrated supply chains can enable faster and deeper mapping, while third-party sourcing introduced additional confidentiality and validation dependencies.

Table 6: Pilot 2 key findings and risks - Phase 1

6. Cross-Pilot Analysis

The two pilots provided comparative insights into aluminium and bauxite supply-chain mapping, stakeholder engagement, ESG data collection and the application of DPP, blockchain and AI technologies. As expected, differences in supplier participation, supply-chain structure and information availability resulted in different levels of upstream visibility, despite both pilots applying the same methodology.

6.1 Comparative Mapping Assessment

Both PCs demonstrated that meaningful supply-chain mapping is achievable at Tier-1 using a combination of supplier engagement, structured questionnaires and supporting desktop research. However, both PCs also confirmed that obtaining information beyond Tier-2 becomes progressively more difficult as buyer leverage decreases and commercial sensitivity increases.

PC1 provided a broader engagement test through multiple Tier-1 pathways and identification of Tier-2 companies, generating valuable insights regarding supplier

participation, escalation mechanisms and onboarding practices. PC2 achieved deeper mapping progress through a more vertically integrated supplier structure and stronger baseline visibility into upstream operations. Together, the two pilots demonstrated that supply chain structure may be as important as supplier willingness when assessing traceability feasibility.

Neither pilot demonstrated a complete transactional chain of custody. Both demonstrated the feasibility of developing progressively validated, point-in-time supply-chain maps that could be structured within a DPP environment.

Supply Chain Tier	Actor Type	Region Represented	Number of Identified Actors	Validation Status
Pilot Companies - Tier-0	Renewable Energy Component Manufacturers	Europe	2	Participating
Tier-1	Component Manufacturers / Fabricators	Europe, Asia	4	Participating
Tier-2	Aluminium Processors, Distributors and Material Suppliers	Europe, Asia	10	Actors identified through supplier disclosure and desktop research; direct engagement and validation varied. This category includes actors within vertically integrated pathways.
Potential Tier-3	Aluminium Processors / Casthouses	Australia	1	Associated with a vertically integrated supplier pathway.
Upstream Target Nodes	Primary Aluminium Producers, Alumina Refiners and Bauxite Sources	Europe, Asia-Pacific and other producing regions	4	Identified within a vertically integrated pathway, including refining and mining operations.

Table 7: Cross-pilot mapping overview

6.2 Comparative Stakeholder Engagement Assessment

Across both pilots, downstream buyer sponsorship, procurement involvement and escalation support were central to supplier participation. Engagement was stronger when requests were supported through existing commercial relationships and weaker when participation appeared entirely optional. Gradual requests, translated materials, tailored

onboarding and supplier-specific examples supported engagement, while parallel pathways reduced dependency on individual supplier responses.

6.3 Comparative ESG Assessment

Across both pilots, company-level ESG information was more readily available at Tier-1 than product-specific or upstream ESG information. Supplier maturity varied, and public indicators provided useful context but did not substitute for supplier evidence. The results therefore supported a screening-based approach during initial mapping, followed by deeper assessment when engagement and supporting documentation become available.

Cross-Tier-1 ESG observations

Several common themes emerged across the participating Tier-1 suppliers:

- Most suppliers possessed at least some ESG-related policies, management systems or sustainability processes.
- ESG information became less available beyond Tier-1.
- Company-level information was generally more mature than product-specific information.
- Upstream ESG information remained highly dependent on supplier willingness to engage and share information.
- Certifications and public sustainability disclosures provided context but did not substitute for supplier-provided evidence.

6.4 Phase 1 Technology Assessment

Across both pilots, participating companies generally had a digital foundation for DPP implementation, although familiarity and readiness varied.

In Pilot 1, two participating companies reported prior familiarity with DPPs, while one was unfamiliar with the concept; PC1 had also participated in an earlier traceability pilot. In Pilot 2, PC2 and its active Tier-1 supplier were familiar with DPPs, and the supplier had explored potential solutions without implementing one. Participating companies also reported established enterprise resource planning (ERP) systems, although supplier data exchange remained largely document- and email-based.

Supplier interest in DPPs was stronger than anticipated for a mapping-first pilot. Tailored demonstrations using supplier-specific SMRT data generated practical questions on data fields, confidentiality, chain-of-custody visualisation and evolving ESPR requirements. This indicated that DPP demonstrations can support both engagement and organisational readiness.

AI-assisted desktop research was applied most extensively in Pilot 2, where preliminary pathways based on public information, certification data and company disclosures were reviewed by Responsible Trade, PC2 and the participating supplier. The approach supported confirmation, correction and supplementation of proposed relationships; it did not replace supplier input. No equivalent supplier-supported validation exercise was

completed in Pilot 1. The results indicated that AI-assisted mapping can support engagement and validation when combined with supplier participation and human review.

Demonstrations also generated questions about blockchain, data storage, access and commercially sensitive information. Blockchain was therefore positioned as an integrity, versioning and auditability layer - not as a mechanism for verifying supplier declarations. Table 8 summarises the cross-pilot technology assessment.

Technology area	Cross-pilot assessment
DPP readiness	Existing ERP/business systems provided a digital foundation for DPP implementation. DPP familiarity varied, but willingness to explore the concept and platform was higher than initially anticipated.
Data structuring & reuse	SMRT information was reused to populate DPPs, linking supply chain mapping and ESG collection with digital traceability rather than creating a separate data collection process.
Chain-of-custody representation	DPPs can connect entities, facilities, materials and processing stages as mapping progresses. The achievable detail depends on the availability and validation of upstream information.
Selective disclosure	Public, transparent and private visibility settings, controlled access and anonymised representation provided options for managing commercially sensitive information.
Blockchain – integrity & versioning	Blockchain-supported records add value through versioning, integrity and auditability as information develops, but do not verify the accuracy of the underlying supplier information.
AI – research & data structuring	AI-assisted public-source research, source comparison, gap identification and DPP data structuring. AI-assisted findings require source review and, where relevant, supplier confirmation.
Verification	This remains the principal cross-technology limitation. Credible traceability depends on supplier confirmation, supporting evidence and validation of the underlying material-flow relationships.
Scalability & integration	Existing enterprise systems provide a basis for future integration. Pilot-scale manual and batch approaches are workable, while higher-volume implementation may require stronger system integration and data governance via APIs.

Table 8: Cross-pilot technology assessment overview

Two conclusions emerged. First, existing enterprise systems provided a starting point, but DPP readiness also required relevant information to be identified, structured and connected across internal departments and supplier organisations. Tailored demonstrations helped translate DPPs from an abstract requirement into a practical planning tool. Second, the principal constraint was not the technical creation of a digital record but the availability,

validation and disclosure of upstream information. DPPs, blockchain and AI could respectively structure, preserve and support the identification of information, but none replaced supplier participation or evidence validation.

7. Stakeholder Engagement Summary

Stakeholder engagement was a core workstream throughout Phase 1 and was implemented at several levels:

- Project governance with the IRBC Agreement secretariat
- Coordination with the two pilot companies throughout Phase 1
- Direct engagement with Tier-1 suppliers
- Initial cascading engagement towards upstream actors
- Initial dialogue with the Aluminium Stewardship Initiative (ASI)

The engagement approach reflected the contractual requirement to work proactively with the IRBC Agreement secretariat, pilot companies and suppliers, and to document outcomes and lessons relevant to scalability.

7.1 Engagement Strategy Applied

The strategy followed a downstream-to-upstream cascading approach, beginning with the IRBC Agreement secretariat and the two pilot companies, progressing through Tier-1 suppliers and, where feasible, to upstream actors. The main engagement mechanisms included:

- **Regular project governance with the IRBC Agreement secretariat:** Minespider and Responsible Trade maintained recurring coordination with the IRBC Agreement secretariat to review progress, risks, supplier participation, methodological questions and required adaptations. Meetings were held weekly during the first month and every two weeks thereafter. This provided a mechanism for alignment and project-level escalation throughout Phase 1.
- **Regular pilot-company engagement:** Weekly recurring meetings were maintained with the participating pilot companies to review mapping progress, identify and prioritise suppliers, coordinate introductions, address supplier responses and agree follow-up actions. Weekly coordination was supplemented by ad-hoc sessions where specific issues required resolution and parallel email communication.
- **Buyer-led introduction and escalation:** the Supplier Engagement Plan prioritised introductions through the existing commercial relationship between the pilot companies and their suppliers. Where initial engagement or subsequent upstream introductions did not progress, follow-up could be escalated through the relevant relationship owner and pilot-company procurement/buyer contacts.
- **Structured but proportionate supplier engagement:** suppliers were first introduced to the purpose and boundaries of the pilot before detailed information was requested. Separate onboarding sessions took place with customised presentations

for each participant. The project was positioned as a traceability and feasibility exercise rather than an audit or supplier-performance assessment.

- **Cascading upstream engagement:** participating Tier-1 suppliers were asked to identify relevant Tier-2 actors and, where possible, facilitate introductions, with the intention of repeating the engagement process progressively upstream. Where operational contacts were insufficient to unlock the next tier, the escalation approach provided an alternative route through the relevant procurement or buyer relationship.
- **Parallel supplier pathways:** following limited participation through some initially selected preferred Tier-1 suppliers from both pilots, engagement was expanded to multiple Tier-1 pathways rather than relying on one supplier route.
- **Tailored engagement:** supplier-facing materials and discussions were adapted according to supplier circumstances, including translated materials, targeted clarification calls, confidentiality explanations and NDA options where relevant.
- **Mapping and platform onboarding as related but separate activities:** suppliers could contribute to mapping without immediately using the DPP platform. Platform onboarding and tailored DPP demonstrations were offered as an additional engagement mechanism rather than as a prerequisite for participation.

7.2 Activities Performed

Table 9 summarises the governance, supplier engagement, data-collection, mapping and platform activities completed during Phase 1.

Engagement activity	Purpose / Phase 1 application
IRBC Agreement secretariat coordination meetings	Progress review, methodology alignment, risks, escalation, reporting and next-step coordination.
Pilot-company recurring meetings	Supplier selection, mapping progress, introductions, follow-up actions and issue resolution.
Pilot-company/IRBC Agreement secretariat joint sessions	Wider progress review and alignment across participating stakeholders.
Supplier Engagement Plan implementation	Structured supplier identification, buyer-led introduction, initial engagement, SMRT completion and progression towards upstream engagement.
Supplier onboarding and alignment calls	Explain project purpose, scope, expected contribution and cascading mapping approach.
SMRT distribution and review	Structured collection of supply chain, ESG and due diligence information.
Supplier follow-up meetings	Clarify responses, missing information, upstream actors and confidentiality questions.

Escalation activities	Follow-up through relationship owners and procurement/buyer contacts where direct engagement or upstream introductions stalled.
Platform onboarding and demonstrations	Familiarise participants with DPP functionality and demonstrate how mapping information can be structured and selectively shared.
Tailored DPP examples	Reduce supplier effort by reusing information already provided and demonstrating a supplier-specific use case.
Translation and adapted materials	Support engagement across different geographical and organisational contexts.
Confidentiality/NDA discussions	Address concerns regarding commercially sensitive supply chain information.
Sector/certification stakeholder engagement and research	Engagement with and review of relevant sector and certification sources, including ASI, to understand available certification information and support upstream mapping and validation discussions.
Public-source research	Review company websites, reports and other public information to identify potential upstream actors and prepare supplier validation discussions.
Internal Minespider/Responsible Trade coordination	Consolidate supplier information, mapping findings, engagement status, risks and next actions.

Table 9: Phase 1 - summary of activities

The meeting pattern confirmed that engagement was maintained throughout Phase 1 rather than concentrated at project initiation.

7.3 Participation Overview

Phase 1 maintained project governance and engagement with both pilot companies and four active Tier-1 pathways. Activities included recurring coordination, supplier onboarding, SMRT review, mapping and DPP demonstrations.

Total Meetings	Internal vs. External Meetings	Active Tier-1 pathways	Tier-1 platform accounts created
At least 90	At least 24 internal and 66 external meetings	4	3 out of 4 invites for accounts sent

Table 10: Phase 1 stakeholder engagement summary

Pilot 1 participation

PC1 developed the broader Tier-1 engagement pathway, with three active supplier routes. The PC1 stream comprised of at least 33 recorded meetings: at least 22 core coordination sessions and 11 supplier-specific sessions.

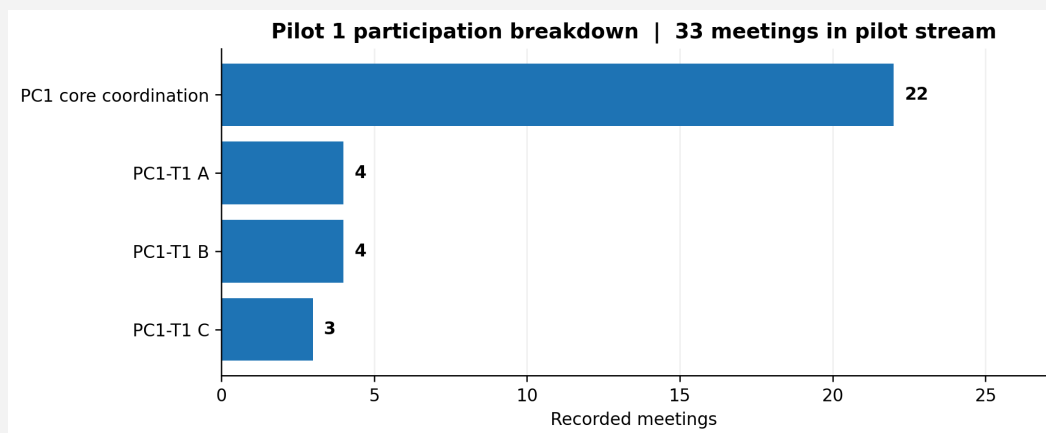


Figure 1: Pilot 1 participation breakdown

Pilot 2 participation

PC2 maintained recurring coordination while one Tier-1 pathway progressed into substantive mapping and DPP engagement. The PC2 stream comprised of at least 21 recorded meetings: at least 19 coordination sessions and 2 supplier-specific sessions.

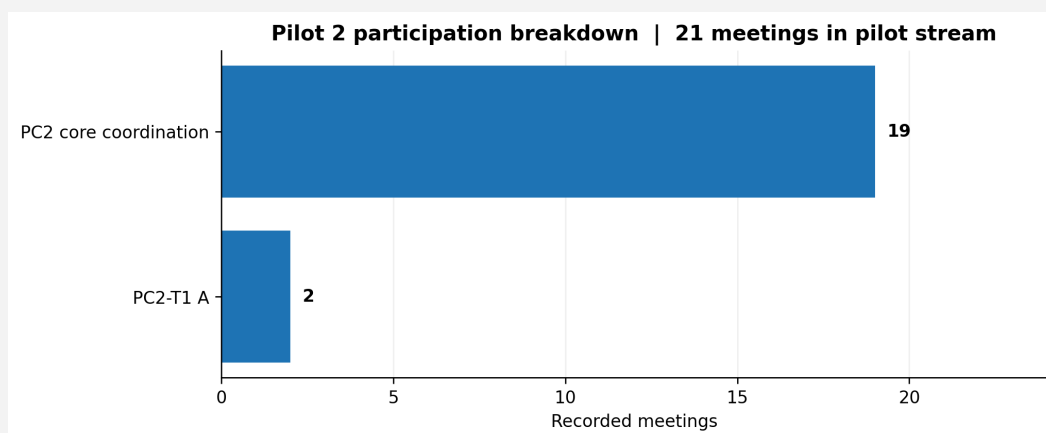


Figure 2: Pilot 2 participation breakdown

Pilots & Tier-1 Engagement

The supplier timeline illustrates the variation in the time required to move from first outreach to substantive engagement. Early participating suppliers progressed within 8-11 days, while other pathways required 45-51 days and repeated follow-up. This reflects differences in supplier priorities, internal ownership, availability and readiness to engage rather than a single onboarding pattern.

Pilot Company	Tier-1 Suppliers	First Email	First Call / Onboarding	Days to Engagement	Passports created
PC1	PC1-T1 A	13 Apr	21 Apr	8 days	1

PC1	PC1-T1 C	13 Apr	28 May	45 days	0 (account not created during Phase 1)
PC1	PC1-T1 B	13 Apr	3 Jun	51 days	1
PC2	PC2-T1 A	13 Apr	24 Apr	11 days	1

Table 11: Engagement timelines for Pilot 1 and 2

Participation, onboarding and DPP use

Platform participation complemented mapping rather than serving as a precondition. Supplier-specific demonstrations reused SMRT information, reduced duplicate requests and made the DPP use case more tangible.

Participant	Recorded meetings	Engagement / onboarding status	DPP / platform activity
PC1	22 core coordination	Active throughout Phase 1; supplier introductions, mapping review and follow-up	Platform account active; tailored DPP approach demonstrated
PC1-T1 A	4	Account created; onboarding completed	SMRT data prepared for DPP creation; 1 published passport
PC1-T1 B	4	Account created; onboarding progressed	1 published passport
PC1-T1 C	3	Active in mapping/data follow-up; no account created during Phase 1	0 passports; mapping continued without platform onboarding
PC2	19 core coordination	Active throughout Phase 1; supplier outreach, mapping and DPP testing	2 published passports
PC2-T1 A	2	Account created; onboarding completed	1 published passport

Table 12: Participation and DPP status of activities for Pilot 1 and 2

7.4 Main Challenges Encountered

Table 13 summarises the principal constraints affecting the speed and depth of engagement and explains why direct Tier-1 participation progressed further than upstream engagement.

Challenge	Phase 1 observation / impact
Supplier participation and upstream access	Supplier willingness varied considerably. Some Tier-1 suppliers engaged actively, while others declined or did not respond. Progress towards Tier-2 was more difficult because the Extended PT had limited direct leverage over upstream actors and depended on Tier-1 suppliers and pilot-company procurement contacts to facilitate introductions.

Procurement and escalation dependencies	Operational contacts were not always able to unlock upstream participation. In these cases, progress depended on escalation through the relevant buyer, relationship owner or procurement function, reinforcing the importance of the Supplier Engagement and Escalation Plan described in Section 3.2 and applied within Sections 4.2 and 5.2.
Confidentiality and NDA requirements	Some suppliers were reluctant to disclose upstream identities or sourcing relationships due to commercial sensitivity. Additional clarification on the pilot scope, NDA options and controlled information sharing mechanisms was therefore required before certain information could be discussed or shared.
Timing and availability	Vacation periods and availability of key procurement, sustainability and technical contacts extended several engagement timelines. The recorded supplier journeys show that the time between initial outreach and starting onboarding engagement varied significantly.
Language and capability differences	Participants had different levels of traceability knowledge and familiarity with DPPs. Translated materials, simplified explanations and tailored onboarding were required in some cases to support effective participation.
DPP participation and account ownership	Platform onboarding raised practical questions around who within the participating organisation should own or manage the DPP account, whether suppliers were expected to use the platform directly, and what role the pilot company would play. This required clarification alongside the mapping activities rather than assuming a uniform operating model.
Use of sample and preliminary data	Sample data was useful for demonstrating DPP functionality before complete supplier information was available. Any sample or preliminary information retained in passports needs to be clearly distinguished from validated supplier data to avoid creating an inaccurate impression of traceability completeness.
Desktop research vs. confirmed material flow	Public sources, including company information and ASI certification records, supported identification of potential upstream actors and preparation of supplier discussions. However, these findings do not independently confirm that a facility or relationship forms part of the specific material flow being traced. Clear distinction between supplier-confirmed, evidence-supported, inferred and unresolved information is therefore required.

Table 13: Challenges and Impact in Phase 1

7.5 Lessons Learned from Phase 1

1. Retain active buyer support and a defined escalation structure.

Phase 1 confirmed the importance of introducing suppliers through existing commercial relationships. PT follow-ups maintained momentum, while pilot-company relationship owners and procurement teams provided additional support where responses or upstream introductions required reinforcement. Future IRBC Agreement projects should retain this combination through a Supplier Engagement and Escalation Plan that defines responsibilities, follow-up routes and escalation mechanisms from project initiation.

2. Maintain flexibility to expand supplier pathways where this strengthens the assessment.

The project initially envisaged engagement through one preferred Tier-1 supplier for each pilot. During Phase 1, Minespider and Responsible Trade proposed expanding engagement to additional relevant suppliers to strengthen the feasibility assessment and reduce reliance on a single route. This proved valuable. Future projects should retain flexibility to broaden supplier engagement where appropriate, while allowing sufficient time when mapping forms part of the engagement.

3. Treat engagement as an ongoing and supplier-specific process.

Phase 1 used recurring emails, clarification calls, SMRT discussions, onboarding sessions and pilot-company coordination. Engagement formats were also adapted through translated materials, tailored examples, written follow-ups and individual onboarding. This combination was important because supplier response times, capabilities and organisational contexts varied. Future engagement plans should therefore provide for repeated, structured and context-specific follow-up.

4. Retain a gradual and proportionate approach to information requests.

The methodology introduced the project and its objectives before progressively requesting mapping, ESG and supporting information. This kept requests manageable while allowing the depth of information to increase as engagement developed. Future projects should retain this staged approach rather than request all potential information at the outset.

5. Retain the mapping-first approach to digital traceability.

Suppliers could initially participate through the SMRT, discussions and existing documentation without being required to adopt the DPP platform. DPP demonstrations were introduced progressively, using supplier-specific examples based on information already provided through the mapping exercise. This made digital traceability more tangible without creating an additional condition for initial participation and can be replicated in future projects.

6. Address confidentiality throughout the engagement process.

Phase 1 anticipated that commercially sensitive information could affect participation and therefore provided confidentiality clarification, NDA options and differentiated data visibility. Support from the pilot companies was particularly valuable as engagement progressed towards upstream sourcing relationships. Future projects should retain these mechanisms and apply them according to the sensitivity of the information and the concerns raised by suppliers.

7. Combine desktop research with systematic engagement monitoring.

Public company information and relevant sector and certification sources, including ASI, supported preliminary mapping and more targeted supplier discussions. Research findings should continue to be distinguished from supplier-confirmed material flows. In parallel, projects should monitor a concise set of indicators - such as response time, participation status, information completion and upstream introductions - to guide follow-up, escalation and decisions on whether to expand supplier pathways.

Phase 1 results indicated that the stakeholder engagement methodology provided a credible basis for wider application across IRBC Agreement companies' supply chains, provided that scaling is supported by active downstream buyer sponsorship, parallel supplier pathways, proportionate information requests, clear confidentiality mechanisms and structured escalation. Future projects should prioritise deepening the established mapping and securing direct engagement with the most relevant identified Tier-2 and upstream actors, while continuing to test and document which engagement and escalation mechanisms are most effective for wider application.

8. DPP, Blockchain & AI Feasibility Assessment

Phase 1 assessed the practical role of DPP, blockchain and AI alongside the supply chain mapping and supplier engagement activities across both pilots. The assessment focused not only on technical functionality, but also on the conditions required for credible adoption, including data availability, validation, confidentiality, supplier participation and governance.

8.1 DPP and Blockchain Assessment

Role of the DPP in Phase 1

Phase 1 assessed the DPP as the digital information-sharing layer of the traceability process. Once products, suppliers and upstream relationships are identified through mapping, the DPP can structure and link information on products, materials, entities, facilities, ESG matters and supporting evidence. Blockchain-supported records provide versioning and auditability as the information is updated, supporting the integrity and immutability of the DPP record.

The DPP should, however, be distinguished from the mapping and verification process itself. It can record and connect available information, but does not independently establish or verify the underlying supply chain. Its reliability depends on the source and validation status of the data, for which the passport creator remains solely responsible.

What was explored

Phase 1 explored the DPP through sample passports, supplier-specific demonstrations and passports populated with information collected during mapping. Sample data was used during initial onboarding where supplier information was not yet available. The pilots also explored chain-of-custody representations linking entities, facilities, materials and processing stages where sufficient mapping information was available.

Flexibility and participant feedback

Participants who accepted the platform invitation and created accounts were primarily motivated by two factors: the request and support of the respective pilot company, and the growing regulatory relevance of DPPs under ESPR. The upcoming requirements also created interest in exploring how a DPP platform works in practice and how such tools could

support organisational readiness and future planning as product-specific regulatory obligations develop.

During our interactions with the pilot participants, interest was shown in including additional company- or product-specific information, including more granular carbon-emissions data. The configurable DPP structure allowed additional fields to be incorporated alongside the standard data model, demonstrating flexibility as traceability and regulatory requirements evolve.

Participants also repeatedly raised practical questions around:

- where data is stored and who can access it;
- whether platform use is voluntary or mandated by the downstream buyer;
- how commercially sensitive upstream information can be represented; and
- which information may ultimately be required under ESPR and future DPP requirements.

These discussions indicate that DPP adoption is not solely a technical question. Data governance, confidentiality, buyer expectations and regulatory relevance are important adoption factors alongside platform functionality.

Data confidence, confidentiality and visibility

Phase 1 demonstrated the importance of recording information provenance and confidence status within the DPP. Supplier-confirmed information, evidence-supported research, inferred relationships and unresolved gaps should be clearly distinguished through labelling, supporting documentation and visibility settings.

Traceability boundaries

Two important limitations emerged from Phase 1.

First, DPP granularity depends on the availability and reliability of upstream information. A multi-tier chain of custody can be represented where the relevant entities, materials and relationships are known, including where upstream parties do not use the platform directly. Where this information is incomplete, the DPP can provide only a higher-level representation or reference supporting documentation.

Second, Phase 1 confirmed that the DPPs demonstrated point-in-time traceability rather than continuous transactional tracking. A DPP can represent information applicable to a defined product, batch, shipment or reporting period, but should not be interpreted as evidence that the same physical material flow continues over time.

Regulatory relevance

Regulatory developments provided an additional engagement driver. Participants showed interest in ESPR, future DPP requirements and the data points that may ultimately need to be captured. Minespider and Responsible Trade provided a separate regulatory update to the pilot participants.

Potential benefit	Phase 1 assessment	Limitation / consideration
Data integrity, versioning and auditability	Provides a persistent record of passport information and updates, supporting versioning, auditability and confidence in the integrity of the digital record.	Does not prove that the original supplier declaration or mapped relationship is correct.
Digital chain of custody	Allows established relationships between entities, materials and successive product stages to be digitally represented.	Granularity depends on supplier participation, available evidence and appropriate entity/material structures.
Controlled information sharing	Public, transparent and private layers, recipient controls and anonymisation support differentiated disclosure. Access controls also support selective sharing with third parties.	Confidentiality controls cannot remove supplier reluctance to disclose; excessive masking can reduce transparency.
Flexible data model	Allows standard DPP information to be supplemented with additional fields, including participant-specific ESG or carbon data and fields required by future regulatory templates.	Data quality and responsibility remain with the information provider/passport creator.
Regulatory readiness	Provides a structure that can evolve as ESPR and product-specific DPP requirements become clearer.	Pilot implementation should not be interpreted as evidence of future regulatory compliance.
Scalability and integration	Manual, batch and assisted creation methods support pilot-scale implementation; digital records can be progressively expanded.	Higher-volume or transactional use may require API/system integration, stronger governance and wider supplier adoption.

Table 14: Overview of the DPP and blockchain benefits and limitations

Overall, the Phase 1 assessment indicates that the DPP and blockchain approach was technically feasible and provided practical value for structuring, linking, versioning and selectively sharing traceability information. Its effectiveness depended on the availability, validation and disclosure of the underlying data.

8.2 AI Assessment

Role and application in Phase 1

Phase 1 assessed AI as a supporting tool for public-source supply-chain research and DPP data structuring.

For supply chain mapping, AI-assisted research was limited to publicly available information, including company websites, published reports and relevant industry or certification sources such as ASI. It was used to help identify potential upstream actors, facilities and relationships, compare information across public sources and highlight gaps requiring further investigation.

Where direct supplier information was incomplete, AI-assisted research enabled preliminary pathways to be developed and subsequently presented to suppliers for confirmation, correction or supplementation. Confidential or non-public supplier information was not used as an input for AI-assisted mapping research.

Key limitations and risks

AI-assisted findings were treated as research leads rather than verified traceability information. Public sources may identify company assets or relationships without demonstrating that they relate to the specific material flow being traced. Findings therefore require review of the underlying sources and, where relevant, supplier confirmation.

Commercially sensitive information should not be processed using non-approved external AI tools, and AI-generated supplier-facing materials, including translations, require human review.

Potential benefit	Phase 1 assessment	Risk/limitation
Public-source research	Accelerates research across publicly available company websites, published reports, ASI and other relevant industry or certification sources.	Public information may identify plausible upstream relationships without demonstrating product-specific material flows.
Source comparison and gap detection	Helps compare available public evidence and identify missing actors, facilities, relationships or data points.	Potential relationships and identified gaps require human review and, where relevant, supplier confirmation.
Research scalability	Enables larger volumes of public information and potential upstream relationships to be identified more efficiently.	Scaling increases the need for consistent source attribution, evidence-status controls and validation.
DPP data structuring	AI-assisted functionality can support the extraction and population of structured passport fields, reducing manual data entry.	Output remains dependent on the quality of the underlying information and requires human review.
Evidence transparency	AI can support rapid synthesis and comparison of information.	The underlying source evidence, rather than AI-generated conclusion, should form the basis for traceability validation.
Confidentiality	AI-assisted mapping research in Phase 1 was limited to publicly available information.	Any future use involving non-public or commercially sensitive data requires approved tools, appropriate safeguards and clear data-governance rules.
Supplier-facing materials	AI can support the preparation and translation of explanatory materials.	AI-generated translations or technical content require human review before external use.

Table 15: AI assessment summary for Phase 1

8.3 Conclusions on Technology Feasibility

Based on the activities completed during Phase 1, the technologies assessed were found to be feasible and complementary, but not standalone solutions for supply-chain mapping. DPP and blockchain technologies provided a digital structure for linking, maintaining, versioning and selectively sharing traceability information, while AI supported research, extraction and data structuring. The quality and depth of the resulting digital records nevertheless remained dependent on supplier participation, the availability and validation of upstream information, clear data governance and appropriate disclosure arrangements.

9. Risks, Gaps, Challenges and Mitigations

Phase 1 confirmed the technical feasibility of supply chain mapping, ESG data collection and DPP-enabled traceability in the aluminium/bauxite supply chain. It also identified practical constraints affecting the speed, depth and reliability of traceability outcomes.

9.1 Supply Chain Risks

The principal supply chain risk identified during Phase 1 was declining supplier participation as mapping progressed upstream. Engagement at pilot-company and Tier-1 levels was achievable, but willingness to share information or facilitate introductions decreased beyond Tier-1. The risk was lower where procurement support and established commercial relationships were available. Other risks included:

- Supplier prioritisation of commercial activities over traceability initiatives
- Confidentiality concerns regarding disclosure of supply chain relationships
- Changing sourcing structures over time
- Dependency on individual relationship owners
- Reduced leverage over sub-tier suppliers
- Differing levels of traceability maturity across suppliers

Supply chain structure also influenced traceability outcomes. During Phase 1, the vertically integrated structure observed in Pilot 2 provided greater visibility than the more fragmented pathways involving multiple independent actors.

9.2 Gaps

A number of information gaps remained at the end of Phase 1.

Mapping gaps

- Direct Tier-2 participation was limited
- Smelter, refinery and mine relationships were only partially validated
- Several identified pathways were based on supplier disclosures or desktop research and would require further confirmation
- Product-specific chain-of-custody information was not demonstrated during Phase 1

ESG gaps

- ESG information was available primarily at company level, with limited product-specific data
- Upstream ESG visibility decreased beyond Tier-1
- Supporting evidence remained incomplete for several ESG responses
- Public information and certification data could support screening but did not substitute for supplier-provided evidence

DPP gaps

- Several DPP examples contained demonstration or sample information
- Ownership and recipient structures required further optimisation
- Aluminium-specific data fields may require refinement as ESPR requirements evolve

These gaps reflect the expected limitations of a feasibility-focused pilot operating in complex multi-tier supply chains and identify priorities for any future work.

9.3 Challenges

Stakeholder Participation Challenges

Supplier participation beyond direct customer–supplier relationships was the principal delivery challenge. Voluntary requests frequently resulted in delays or non-participation, whereas procurement support, existing commercial relationships and clear business expectations improved engagement. Future initiatives may therefore require governance and escalation mechanisms comparable to those used for supplier quality or performance.

Validation Challenges

A second challenge was the distinction between:

- Identified relationships
- Validated relationships
- Disclosed relationships

In multiple cases, the PT identified plausible upstream relationships through supplier information and desktop research. However, validation and permission to disclose these relationships often progressed at different speeds.

Technology Challenges

Technology adoption generated comparatively fewer obstacles. The principal technology-related challenges centred on:

- Account ownership
- DPP governance
- User onboarding
- Confidentiality management
- Readiness of information for inclusion in DPPs

The primary constraints were therefore data readiness and governance rather than platform functionality.

9.4 Mitigation Measures Applied

Supplier Engagement

- Expansion from a single Tier-1 pathway to multiple pathways
- Buyer- and procurement-supported introductions, follow-ups and escalations
- Tailored onboarding sessions and translated supplier materials

Data Collection

- Progressive information requests supported by clarification calls
- Validation reviews combining desktop research and available supplier documentation

Technology and Governance

- Tailored sample DPPs using SMRT data and AI-assisted data structuring
- Visibility controls and controlled information-sharing models
- Validation-status classifications distinguishing supplier-confirmed information from desktop findings
- NDA options and confidentiality guidance

These measures supported supplier participation and strengthened project resilience. They should be considered in future projects of this type.

10. Recommendations for Future Application

From a responsible sourcing perspective, supply chain mapping should be treated as a foundational capability rather than solely as a precursor to traceability. Mapping creates value by increasing visibility into supply chain structures, identifying previously unknown actors and information gaps, supporting risk-based due diligence and enabling more targeted stakeholder engagement. Even where complete upstream traceability is not achievable, it helps companies determine where leverage can be applied and which actors should be prioritised for engagement, ESG assessment or remediation.

This capability can support future initiatives focused on traceability, ESG due diligence, carbon reporting, DPP implementation or responsible sourcing verification.

Scalability and Replication Beyond Aluminium

Phase 1 indicated that the methodology could be adapted to other minerals, materials and supply chains. Its transferability derives from a structured sequence that is not specific to aluminium: buyer-led supplier engagement, supply chain mapping, ESG data collection, targeted desktop research, validation and evidence-status classification, followed by DPP-based information structuring.

The transferable elements of the methodology include:

- Buyer-led and progressive supplier engagement;

- Structured mapping, ESG data collection and targeted desktop research;
- Clear distinction between identified, supplier-confirmed, validated and disclosed relationships; and
- DPP-based information structuring supported by blockchain and AI tools.

The approach can accommodate different levels of supplier maturity because participation can begin through existing documentation, structured questionnaires and clarification discussions without requiring immediate adoption of the DPP platform. Information can then be progressively structured within DPPs as mapping develops and suppliers become familiar with the intended use, visibility and governance of the data.

Replication would require sector-specific adaptation of the SMRT, ESG questions, terminology, certification sources and DPP data fields, but not a fundamental redesign of the engagement and validation process. Potential applications include copper, battery raw materials, steel and other metals, renewable energy equipment, electronics and broader responsible sourcing and due diligence initiatives.

Future applications should replicate and build on the mapping-first approach applied during Phase 1, in which technology supported visibility, validation and information management while supplier engagement remained central to delivery. The active buyer sponsorship, evidence-status labelling, proportionate confidentiality controls and progressive upstream engagement applied during the pilots should remain core elements of the methodology.

11. Conclusion

The project aimed to map aluminium and bauxite supply chains, collect ESG information, and evaluate the practical application of Digital Product Passports (DPPs), blockchain, and AI across two pilot supply chains.

Achievements

1. **Supply Chain Mapping:** The pilot partially mapped supply chains for two companies, establishing multiple Tier-1 and Tier-2 supplier pathways. Visibility and data completeness decreased further upstream due to supplier participation and commercial sensitivities.
2. **ESG Data Collection:** ESG information was gathered using a standardized methodology, with the highest data quality at the pilot company and Tier-1 levels. Public and certification sources supplemented supplier-provided data, but evidence and granularity diminished upstream.
3. **Digital Traceability Tools:** DPPs and blockchain proved effective for structuring, connecting, and auditing traceability and ESG information. AI supported research and data structuring, though all outputs required human validation.
4. **Stakeholder Engagement:** Stakeholder meetings were conducted, leveraging buyer-led introductions and tailored onboarding to encourage supplier participation.

Limitations and Risks

- **Upstream Engagement:** Progress beyond Tier-1 was limited by supplier willingness, commercial confidentiality, and fragmented sourcing structures.
- **Data Validation:** Independent verification of material flows and upstream data remains challenging; DPPs and blockchain cannot confirm actual material movement without additional physical checks.
- **Traceability Boundaries:** The pilot primarily achieved point-in-time mapping rather than continuous, real-time chain-of-custody.

Feasibility Assessment

The pilot demonstrated that partial supply chain mapping and digital traceability are feasible, especially up to Tier-2 and for specific timeframes. However, full mine-level verification and real-time transactional traceability are not yet achievable due to current limitations in supplier participation and data validation. The technical tools are effective for structuring and sharing information, but their value depends on the availability and confirmation of underlying data.

Recommendations for Future Initiatives

1. Prioritise Validation: Deepen and validate existing supply chain pathways rather than expanding breadth.
2. Strengthen Supplier Engagement: Enhance onboarding, provide materials in local languages, and reinforce escalation processes.
3. Focus on Evidence-Backed ESG Data: Target high-risk nodes and avoid over-reliance on public indicators.
4. Align with Regulation: Monitor and adapt to evolving ESPR and DPP requirements; engage with sector initiatives for alignment.

Project Closure

With Phase 2 not proceeding, this report closes the project after Phase 1, consolidating achievements, limitations, and recommendations to inform future digital traceability efforts in the renewable energy sector.

12. Appendices

Appendix A – Stakeholder Engagement Materials

Supplier Engagement Plan

Aluminium & Bauxite Supply Chain Mapping Pilot Wind Energy Sector

Internal Working Version - Mapping First Approach

Objective

To obtain structured upstream mapping information starting from a confirmed Tier-1 supplier, using a cascading engagement model that is proportionate, controlled, and minimally disruptive.

The focus is **mapping first, Digital Product Passport (DPP) structuring second**.

Explicitly out of scope: price, volumes, contractual terms, supplier performance evaluation, audit or compliance judgments.

Guiding Principles

- Mapping before DPP – validate structure first, digitalize second.
- Engagement before documentation – secure buy-in before sending questionnaires.
- Proportionate data requests – limited to role and product scope.
- Layered disclosure – entity/mapping confirmation first, ESG depth later.
- Confidentiality – clarification to be provided, NDA to be considered.

Phase 0 – Internal Preparation (Before Tier-1 Engagement)

- Confirm selected product reference with pilot companies
- Confirm selected Tier-1 supplier
- Conduct targeted public research (smelters, certifications, ESG disclosures).
- Refine questionnaire: focus primarily on mapping, reduce ESG depth and DPP questions;
- Share questionnaire to pilot companies for feedback/alignment
- Prepare Tier-1 'Invitation to join pilot' document (no questionnaire attached).

Phase 1 – Tier-1 Introduction (Relationship-Based)

- Introduction email sent by relationship owner/pilot company.
- Attach 'Invitation to join pilot' document only (no questionnaire).
- Clarify: limited scope, not an audit, no commercial data requested.

- Propose 45–60 minute alignment call (confirm participant, from PM team, and pilot company)

Phase 2 – Tier-1 Mapping Alignment Call (45–60 mins)

- Brief project explanation & cascading engagement approach.
- Walk through the supplier mapping reporting template (SMRT) and process.
- Clarify AI role (data structuring support, not mapping engine).
- Confirm product and upstream production entity (smelter/refinery).
- Understand sourcing structure (single vs multiple sources).
- Agree on Tier-2 introduction pathway.
- Outline next steps and timeline. (SMRT sent over email, Minespider platform onboarding, DPP structure).

Phase 3 – Targeted Questionnaire (After Call)

- Send the questionnaire within 24 hours of call.
- Focus on: supply chain mapping, ESG and Digital Product Passport (DPP) data.
- High level ESG check/evaluation.
- Provide a 2 week response window.
- Offer a short clarification call if needed.

Phase 4 – Tier-2 Cascading Engagement

- Follow the same structured approach with lighter messaging with introduction coming from Tier-1.
- Adapt communication tone/'Invitation to join pilot' document based on geography/sensitivity.
- Focus on entity confirmation and mapping before ESG and DPP.
- Maintain appropriate level of engagement.

Phase 5 – DPP Structuring (Post-Mapping Validation)

- Structure validated mapping information initially in Excel to confirm logic, tier relationships, and product attribution.
- DPP examples will be created only after mapping coherence is confirmed.
- Platform onboarding is handled as a separate, opt-in phase.

SMRT Timing Protocol

- Pilot companies are responsible for initiating and supporting supplier engagement. Contact with suppliers beyond Tier-1 will be conducted only upon introduction by, or with the prior approval of, the respective Tier-1 supplier.
- Use it as an internal discussion guide during the first call.
- Full ESG depth only after Tier-1 engagement stabilizes.

Estimated Timeline

- Tier-1 alignment & mapping: 3 weeks.
- Tier-X cascading confirmation: additional 3 weeks.

Please note, the timeline is best case scenario and indicative and dependent on supplier participation, availability of supply chain information, and the pace of upstream introductions. Adjustments may be required as the mapping process evolves.

Key Message to Suppliers

This is a structured mapping pilot for a defined product. We are confirming upstream production entities to enable credible traceability. We are not requesting full supply chain disclosure, commercial data, or conducting an audit.

Email template suggestion (if sent from RT/MS):

Subject: Industry Pilot under the IRBC Renewable Energy Agreement – Supply Chain Mapping

Dear [Name],

I hope you are doing well.

Following an introduction from **[Pilot Company / Tier-1 partner]**, we would like to invite your company to participate in a **collaborative pilot mapping aluminium and bauxite supply chains for the wind energy sector**, carried out under the **International Responsible Business Conduct (IRBC) Agreement for the Renewable Energy Sector**.

Participants will receive **free access to a Digital Product Passport platform** and the opportunity to help shape practical approaches to traceability in renewable energy supply chains. The pilot focuses on **supply chain mapping only** and does **not involve audits or requests for commercial data**.

We would welcome the opportunity for a short call (45–60 minutes) to briefly introduce the project and discuss the upstream structure relevant to the product in scope. Please let us know when you are available over the next two weeks so we can set up the call.

For additional context, please find attached a short overview of the pilot initiative.

Thank you in advance, and we look forward to connecting.

Kind regards,

Email template suggestion (if sent from Pilot company):

Subject: Introduction – Industry Pilot under the IRBC Renewable Energy Agreement – Supply Chain Mapping

Dear [Name],

I hope you are doing well. XXXXX is an important supplier to PILOT COMPANY.

PILOT COMPANY is currently participating in an industry pilot focused on mapping aluminium and bauxite supply chains used in the wind energy sector, and we are requesting your company take part given your role in our supply chain.

The initiative is conducted together with Minespider and Responsible Trade under the **International Responsible Business Conduct (IRBC) Renewable Energy Agreement**. The objective is to better understand upstream production entities involved in aluminium supply for wind energy components and support practical approaches to traceability in the sector.

Your participation involves a short introductory call (45–60 minutes) to briefly present the pilot and confirm the relevant upstream production structure for the product in scope.

To clarify the scope of the exercise:

- This is **not an audit or supplier evaluation**
- **No commercial data** (such as prices or volumes) will be requested
- The focus is **high-level supply chain mapping only**
- Participation is **voluntary and proportionate**

For additional context, please find attached a short overview of the pilot.

We are happy to coordinate a suitable time in the next couple weeks for a short introduction with the project team. Please let us know what times work for you.

Thank you in advance, and we look forward to connecting.

Kind regards,

Escalation Plan

IRBC Agreement for the Renewable Energy Sector: Blockchain & AI Traceability Pilot
Aluminium/Bauxite Traceability for Wind Sector Supply Chains Components

1. Purpose

This Escalation Plan defines the process to be followed in the event of **supplier non-participation, insufficient cooperation, delayed input, low-quality or incomplete data, or the inability to obtain required supply chain information** necessary to perform aluminium/bauxite supply chain mapping and traceability activities within the project.

This includes situations where:

- outreach to suppliers does not result in engagement (triggering escalation to the main contracting party and IRBC Agreement secretariat where applicable),
- traceability gaps are identified and must be formally logged and assessed (including the potential use of AI-assisted inference under controlled conditions),
- ESG-related data quality is insufficient and requires the application of standardised templates and verification steps, and
- The use of AI or automated processing introduces security or integrity risks that must be mitigated through controlled processing and human review.

The objective is to:

- ensure high level of supplier engagement,
- ensure transparency and timely issue resolution,
- protect project timelines and deliverables, and
- provide a structured, fair mechanism for escalation when collaboration challenges arise.

2. Scope

This plan applies to:

- the **main contractor (MS) and the sub-contractor (RT)**,
- participating **pilot companies**, and
- **tier-1 or any upstream supplier** involved in the aluminium value chain for the pilot scope.

It specifically covers issues related to:

- non-response or delayed response to data/information requests,
- refusal or failure to share required supply chain information,
- incomplete or inconsistent data submissions,
- Confidentiality or legal restrictions impacting data disclosures
- lack of engagement in agreed mapping, traceability or validation activities.

3. Guiding Principles

- Escalation is a **last-resort mechanism**, used only after reasonable attempts to resolve issues collaboratively.
- Potential escalations shall be addressed to the minimum necessary level.
- All escalations will be handled **professionally, objectively, and without blame**.
- Issues will be addressed on a **need-to-know basis**, with a focus on resolution rather than fault.
- No party will be subject to reprisal for raising concerns in good faith.

4. Escalation Levels and Process

Workstream related issues shall first be raised within the workstream team via email:

- Issues related to mapping gaps → Mapping Lead (RT)
- Supplier onboarding or late responses → Supplier Engagement Lead (MS)
- Missing ESG disclosures → ESG Data Lead (RT)

Level 1 – Operational Resolution

Trigger:

- Missing data inputs
- Delays beyond agreed timelines
- Limited responsiveness from a project contact

Action:

- The project team (MS & RT) raises the issue directly with the designated operational contact of the relevant party (the Tier-X company or pilot company)
- The issue is clearly documented (data requested, deadline, impact).
- A reasonable remediation period (e.g. 2–5 working days) is provided.

Outcome:

- Issue resolved at working level, or
- Escalation to Level 2 if unresolved.

Level 2 – Project Management Escalation

Trigger:

- No resolution at Level 1
- Repeated delays or partial cooperation
- Confidentiality/legal blockers preventing progress
- Risk to project milestones

Action:

- The issue is escalated to the **project managers** of the relevant parties (pilot companies).
- A structured discussion is held to:
 - clarify constraints or blockers,
 - confirm expectations and revised timelines,
 - assess feasibility within the pilot scope.

Outcome:

- Agreed corrective actions and revised plan, or
- Escalation to Level 3 if cooperation remains insufficient.

Level 3 – Contractual Escalation

Trigger:

- Persistent non-cooperation
- Inability to map the supply chain or onboard despite multiple attempts
- Material risk to pilot objectives or deliverables
- Continued legal or contractual barriers preventing progress

Action:

- Issue is escalated to:
 - senior management of the main contracting authority (SER)
- An assessment is conducted on:
 - impact on project scope and outcomes,
 - feasibility of continuing traceability for the affected supply chain segment.

Outcome Options:

- Scope adjustment (e.g. partial mapping, assumptions clearly documented),
- Replacement or exclusion of a pilot pathway,
- Formal acknowledgment of limitations in final deliverables.

5. Documentation and Transparency

All escalation steps will be:

- documented in the project records,
- reflected in meeting notes or escalation logs,
- transparently referenced in final reports where relevant (e.g. data gaps, assumptions, limitations).

6. No-fault Principle

Failure to obtain full supply chain visibility **will not automatically be considered non-compliance or wrongdoing**. In cases where cooperation cannot be achieved despite good-faith efforts, limitations will be:

- clearly documented,
- communicated to all parties,
- and reflected in the pilot outcomes accordingly (i.e. the stakeholder engagement summary).

7. Key contacts

Main Contractor & Onboarding lead (MS)

Pilot Company 1

Pilot Company 2

ESG / Mapping Lead (RT)
Escalation / Governance Contact

8. Final note

This Escalation Plan is intended to support constructive collaboration and ensure that traceability and mapping objectives are pursued realistically, transparently, and in line with the operational realities of complex aluminium/bauxite supply chains.

One pager Pilot Invitation - Pilot Company 1 (PC1) (anonymised)

Supply Chain Traceability Pilot Aluminium & Bauxite

No Cost Participation | No Audit | Full Confidentiality | No Obligation



How it works (low effort)

- Short onboarding call (up to 45 minutes)
- Minimal engagement (1-2 hours, if needed)
- Share existing documents only (no new reporting required)
- We structure your Digital Product Passport (DPP) based on your data

Pilot goals

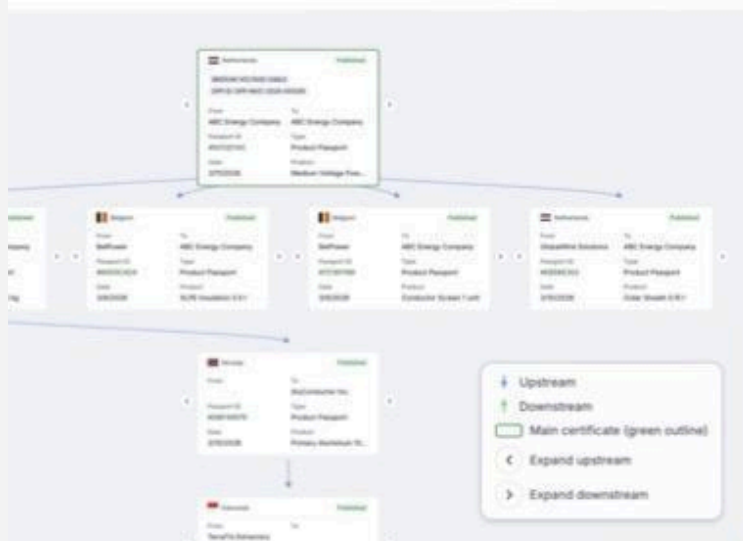
- Map the alumina and bauxite supply chain in a practical, low-effort way
- Provide secure, blockchain-backed Digital Product Passports (DPP) for your product/material
- Structure ESG and traceability data using existing information
- Explore practical approaches to future transparency requirements

What you get (at no cost)

- Access to a Digital Product Passport platform
- A structured way to share information with your customer
- ESG & Traceability data ready for reuse
- Optional early exposure to emerging industry approaches (no obligation)

Why join

- Strengthen customer relationships
- Gain supply chain visibility
- Gain early visibility on upcoming customer and regulatory information requests (e.g. EU-related)



Minespider platform - Chain of Custody example

Data confidentiality

- You fully control what is shared
- Commercial data (pricing, volumes) is not requested
- Private | Transparent | Public Layers
- Blockchain - secured DPP



Scan to preview

Interested in joining

Contact:

Limited number of suppliers

One pager Pilot Invitation - Pilot Company 2 (PC2) (anonymised)

Supply Chain Traceability Pilot Aluminium & Bauxite

Free Participation | No Audit | Full Confidentiality | Voluntarily



How it works (low effort)

- Short onboarding call
- Share existing documents only (no new reporting required)
- If needed, follow up (email/call)
- We structure your Digital Product Passport (DPP) based on your data

Pilot goals

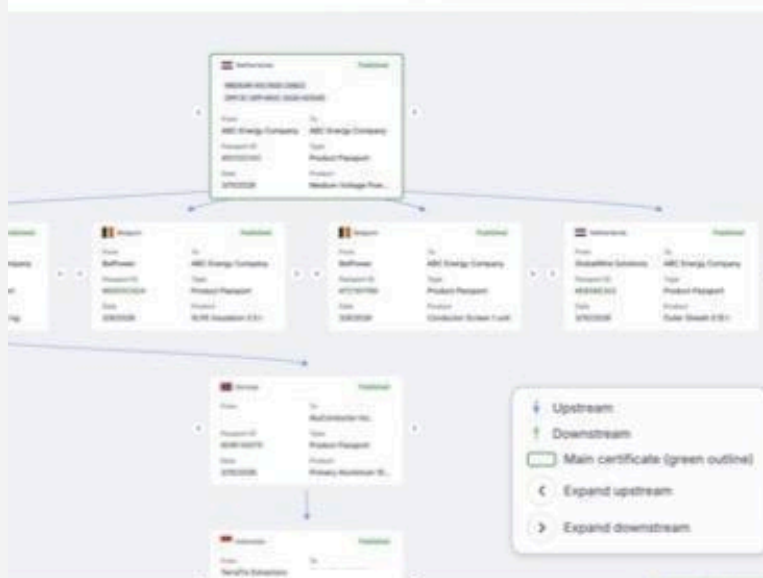
- Map the alumina and bauxite supply chain in a practical, low-effort way
- Provide secure, blockchain-backed Digital Product Passports (DPP) for your product/material
- Structure ESG and traceability data using existing information
- Explore practical approaches to future transparency requirements

What you get (at no cost)

- Access to a Digital Product Passport platform
- A structured way to share information with your customer
- ESG & Traceability data ready for reuse
- Optional early exposure to emerging industry approaches (no obligation)
- Visibility into downstream product destinations, where information is available through participating supply-chain partners

Why join

- Strengthen customer relationships
- Receive a structured view of your supply chain (snapshot in time)
- Share selected information securely via a DPP (QR-code access)
- Gain early visibility on upcoming customer and regulatory information requests (e.g. EU-related)



Minespider platform - Chain of Custody example

Data confidentiality

- You fully control what is shared
- Commercial data (pricing, volumes) is not requested
- Private | Transparent | Public Layers
- Blockchain - secured DPP



Scan to preview a DPP example

Interested in joining

Contact:

pavlina@minespider.com

Invitation only

One-pager pilot invitation (Chinese version) (anonymised)

供应链可追溯性试点计划 铝及铝土矿

无需审核 | 完全保密 | 费用全免



计划目标

- 以低门槛、实用方法将氧化铝及铝土矿供应链可视化
- 为您的产品 / 材料提供由区块链支持的数字产品护照 (DPP)
- 利用现有资料整理ESG及可追溯性数据
- 探索应对未来透明度要求的可行方案

您将可免费

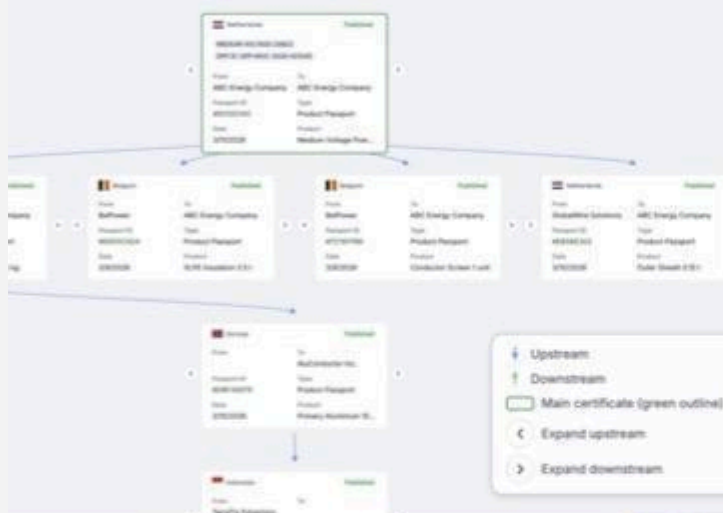
- 使用数字产品护照平台
- 以结构化方式与客户分享资讯
- 重复使用ESG及可追溯性数据
- 提前了解新兴行业方案
- 透过供应链合作伙伴提供的资料掌握下游产品流向的可视性

简单运作

- 开展简短启动通话
- 仅需分享现有文件 (无需新增报告)
- 透过电邮或电话进行后续跟进 (如有需要)
- 根据提供数据建立数字产品护照(DPP)

参与理由

- 强化与客户关系
- 获得供应链结构化视图 (特定时间点快照)
- 透过数字产品护照(DPP) 安全分享指定资讯 (支援QR码存取)
- 提前掌握未来的客户及监管资讯要求 (如: 与欧盟相关资讯)



Minespider 平台—监管链 (Chain of Custody) 示例

数据保密性

- 您可完全掌控分享内容
- 不要求商业敏感数据 (如价格、数量)
- 发布分层: 私密 | 透明 | 公开层级
- 区块链保障数字产品护照 (DPP)



扫描预览数字产品护照 (DPP) 示例

诚邀邀请贵司参与。如有任何疑问, 请与我们联系。

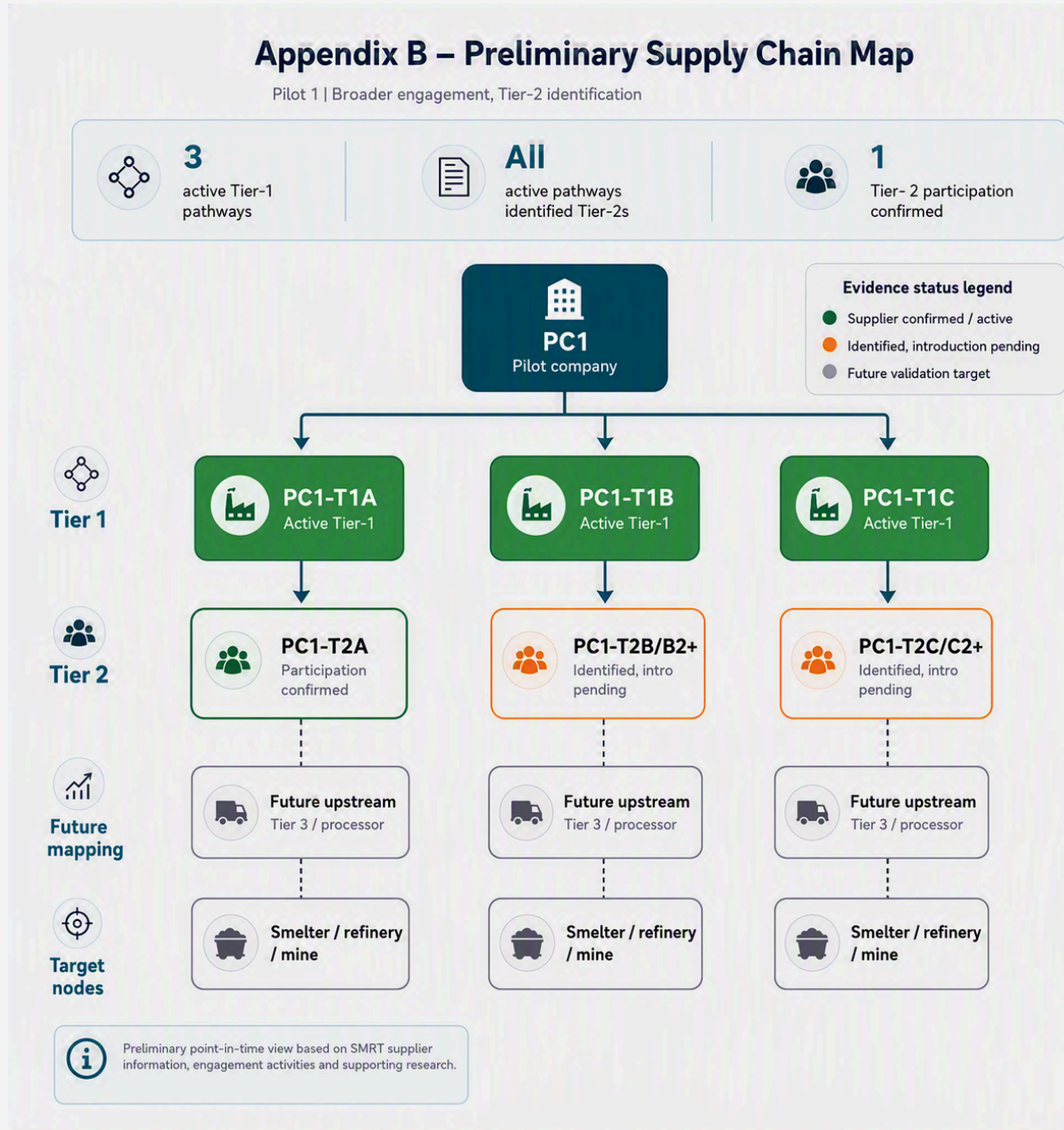
联络: pavlina@minespider.com
jochenmarx@responsibletradellc.com

仅邀请

SMRT (attached separately)

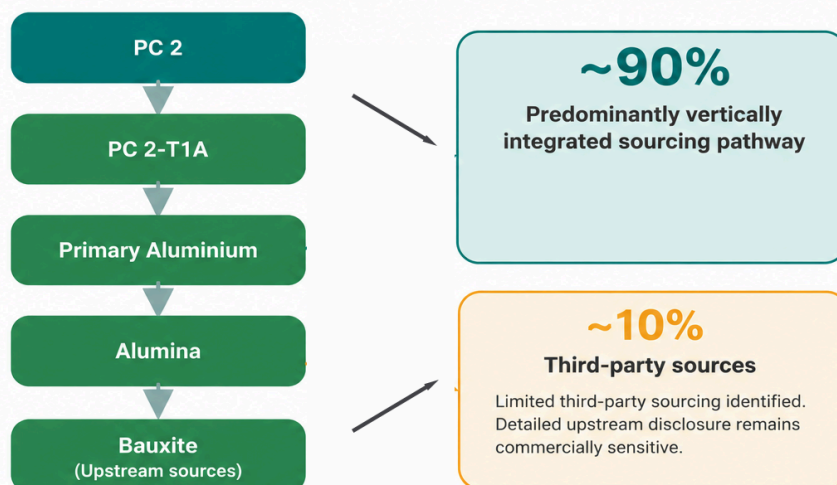
Appendix B – Preliminary Supply Chain Maps at end of Phase 1

Pilot 1



Appendix B – Preliminary Supply Chain Map

Pilot 2 | Deeper upstream visibility through one active pathway



Interpretation

Pilot 2 achieved the deepest upstream visibility in Phase 1, but further evidence collection and validation are required before treating pathways as confirmed product-specific traceability.

Cross-pilot overview

Appendix B – Cross-Pilot Mapping Dashboard

Phase 1 status overview | engagement breadth, mapping depth and validation priorities



Pilot 1

Broader engagement: 3 active Tier-1 pathways, multiple Tier-2s identified



Pilot 2

Deeper visibility: one active pathway with smelting, refining and mining stages discussed

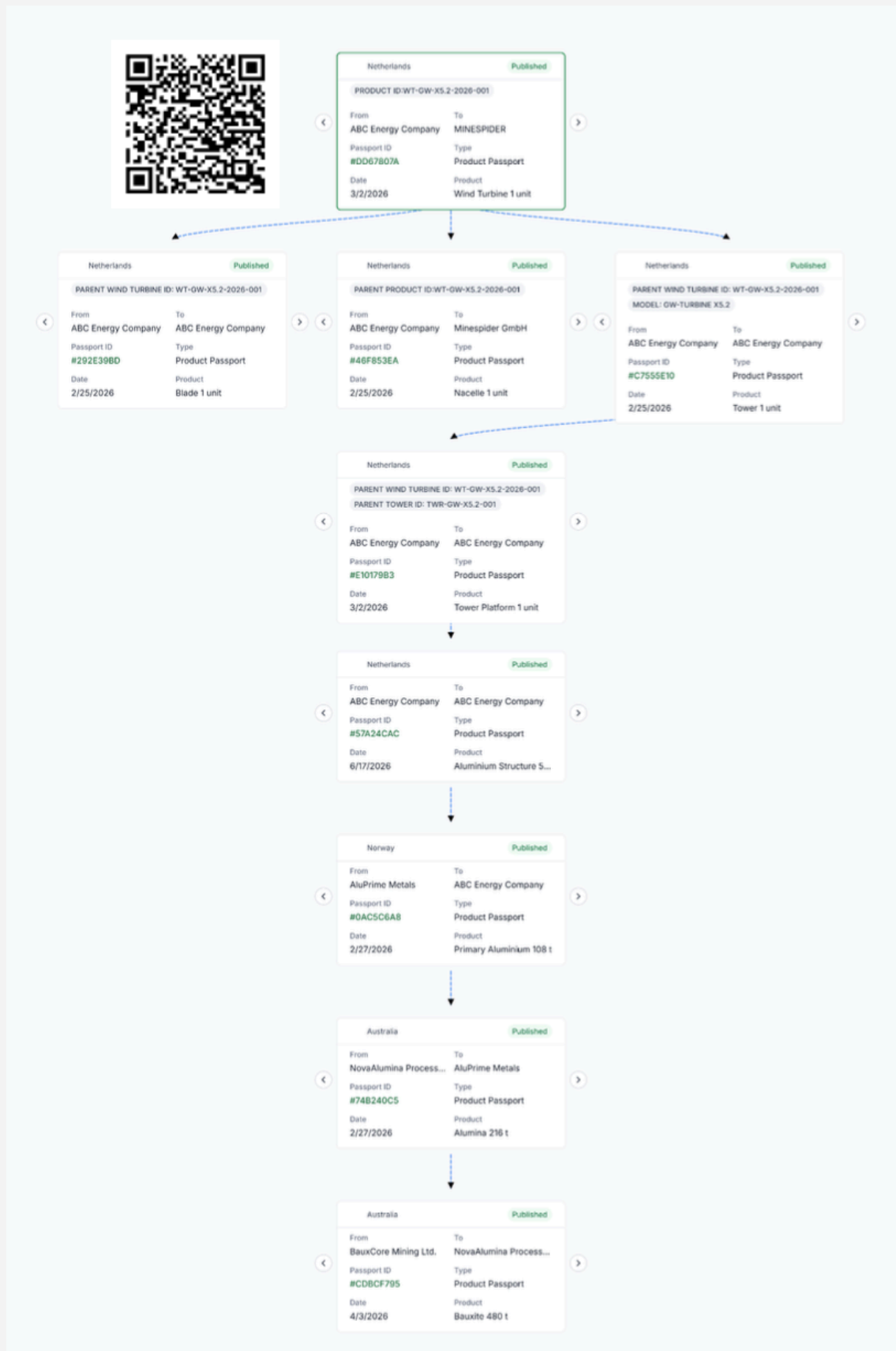
 Route	 Mapping	 Supplier engagement	 Validation	 ESG
 PC1-T1A	 Advanced	 Advanced	 Partial	 Partial
 PC1-T1B	 Advanced	 Advanced	 Pending	 Pending
 PC1-T1C	 Advanced	 Advanced	 Pending	 Pending
 PC1-T1D	 Declined	 Declined	 N/A	 N/A
 PC2-T1A	 Advanced	 Advanced	 Advanced	 Advanced
 PC2-T1B	 No active participation	 No active participation	 N/A	 N/A
 PC2-T1C	 No active participation	 No active participation	 N/A	 N/A
 PC2-T1D	 Declined	 Declined	 N/A	 N/A

Legend

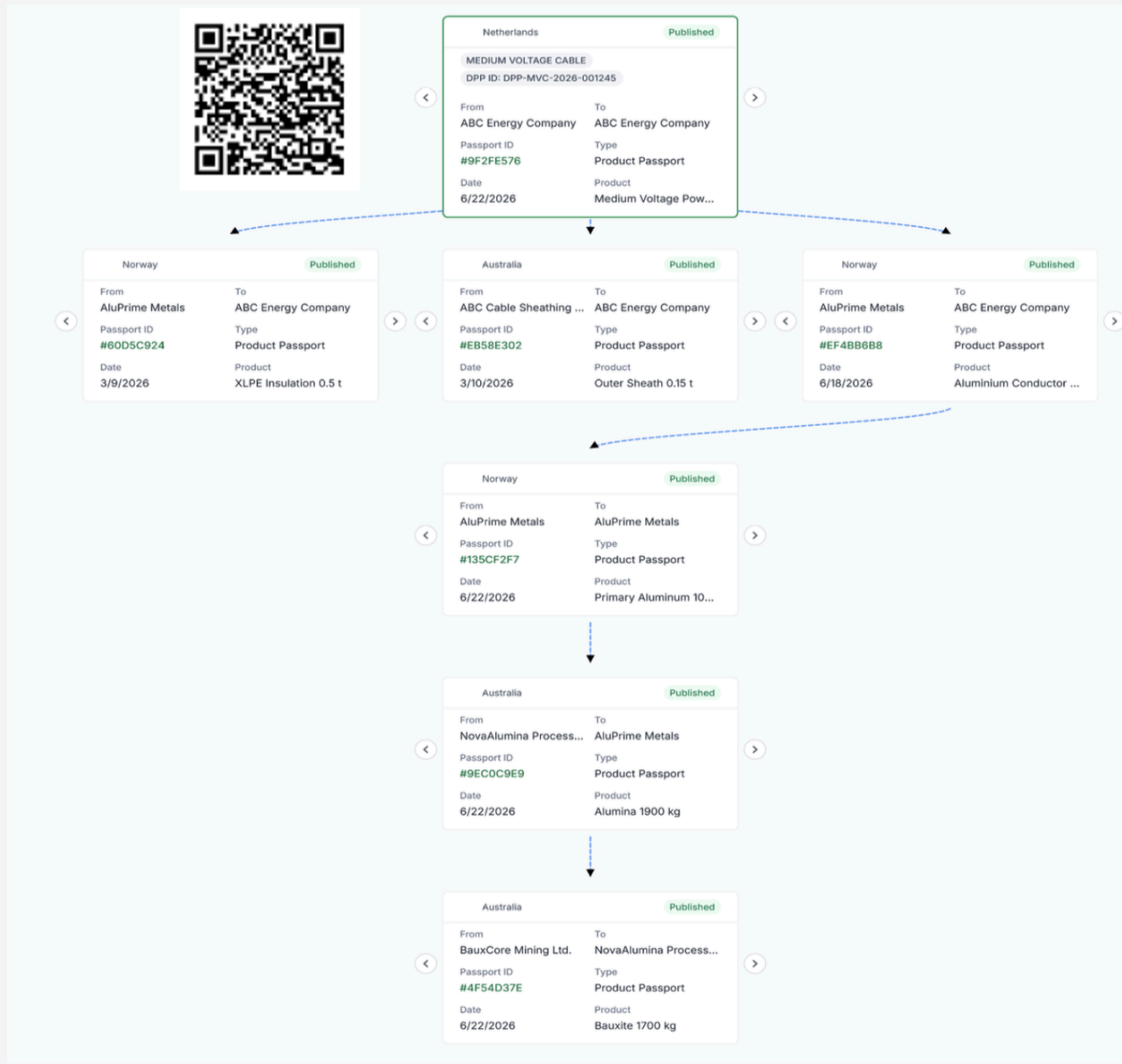
-  Advanced
-  Partial
-  Pending
-  Declined
-  N/A
-  No active participation

Appendix C – DPP Platform Examples & Screenshots

DPP example 1



DPP example 2



Appendix D – SMRT Glossary & Acronyms

1. General

Term	Definition
SMRT	Supplier Mapping Reporting Template used to collect structured supply chain, traceability, ESG, and digital Product Passport-relevant information for specific metals and products.
Supplier	Any legal entity providing products, components, materials or services within the supply chain, including manufacturers, processors, traders, refiners, and recyclers, regardless of tier.
Metal (Generic Use)	For simplicity, the term “metal” may refer to metals, minerals, ores, concentrates, alloys, or processed metal products unless otherwise specified.

2. Supplier Engagement

Term	Definition
Supplier Willingness	The degree to which a supplier is able and willing to share supply-chain, traceability, ESG, and documentation-related information.
Leverage (OECD)	The ability of a company to influence a supplier's behaviour of a supplier to obtain information, improve practices, or prevent and mitigate adverse impacts, consistent with OECD Due Diligence Guidance.
Permission to Contact Upstream Suppliers	Explicit consent (or refusal) provided by a supplier allowing the customer or downstream company to directly contact identified upstream suppliers for verification or clarification purposes (Sheet 3, Section E1).
Information Constraint / Limitation	Any legal, contractual, commercial, or practical restriction that limits the level of detail a supplier can provide (e.g. inability to disclose site-level data or upstream actor names).

3. Supply Chain Structure & Scope

Term	Definition
Tier-1 Supplier	Supplier that has a direct contractual relationship with the customer (e.g. the pilot company).
Tier-2 / Tier-3 Supplier	Suppliers further upstream that provide materials or components indirectly through other suppliers.
Immediate Supplier	The supplier directly preceding the reporting company in the supply chain for the in-scope product.
Upstream supplier	Entities involved in extraction, processing, refining, smelting, recycling, or trading of raw or intermediate materials.
Downstream Company	Entities after smelting/refining including manufacturers, assemblers and distributors.

Control Point	A stage where materials are aggregated, transformed, or re-classified, requiring consolidation of traceability information (e.g. refineries, smelters, casthouses).
In-Scope / Out-of-Scope	Indicates whether a product, metal, supplier, component, processing activity, or documentation element or activity is included or excluded from the current customer request.
Metal(s) in Scope	Metal(s) explicitly requested by the customer (e.g. aluminium), including all primary, secondary, and recycled upstream inputs required to produce the in-scope product.
Product(s) in Scope	Finished or semi-finished product(s) supplied to the customer for which supply-chain mapping, ESG, and DPP-relevant information is requested.
Component / Part	A discrete item, material, alloy, or sub-assembly incorporated into a product, which may contain one or more metals.
Value Chain	All activities required to bring a product from raw-material extraction through processing, manufacturing, distribution, use, and end-of-life.
Covered Minerals	Minerals subject to supply-chain mapping, due diligence, or reporting requirements under this exercise, including aluminium and other metals listed as "in scope."

4. Entity Types

Term	Definition
Downstream Supplier	Entity operating after the smelting and refining stages of the metal value chain, involved in manufacturing, fabrication, assembly, processing, or distribution of products containing the in-scope metal. Downstream suppliers typically purchase metal or metal-containing materials from upstream suppliers and are responsible for product-level traceability, supplier engagement, and risk-based due-diligence activities consistent with OECD guidance.
Trader	Entity that buys and sells materials without physical transformation, often aggregating volumes or transferring legal title. Traders are explicitly in scope of OECD DDG for both upstream and downstream suppliers.
Processor	Entity that refines, smelts, casts, treats, recycles or otherwise transforms materials, including toll processors.
Primary Aluminium Producer	Entity operating aluminium smelters and/or casting facilities that convert alumina into molten aluminium and primary aluminium products such as ingots, slabs, sow blocks, or billets. May include vertically integrated smelting–casting operations (Sheet 3, D1).
Refining and Alumina Producer	Entity processing bauxite into alumina (Al ₂ O ₃) through refining operations, supplying smelters or integrated aluminium producers. Includes standalone refineries and integrated mine–refinery operations (Sheet 3, D1).

Raw Material Sourcing – Bauxite Mine	Entity or site engaged in the extraction of bauxite as the primary raw material for aluminium production. May include large-scale mining (LSM) or ASM where applicable. Disclosure may be site-level or country-level depending on availability and sensitivity (Sheet 3, D1).
Exporter Concentrated Provider	Entity that aggregates, markets, and exports mineral concentrates or intermediate materials (e.g. bauxite, alumina-related intermediates) to downstream processors, refiners, or smelters, without performing final smelting or refining operations itself. May take legal title to the material and operate at a control point between mining, refining, and international trade.
Mine / Mining Operation	A site extracting raw mineral resources (e.g. bauxite). May be ASM (artisanal and small-scale) or LSM (large-scale mining). Disclosure may be site-level or country-level, depending on availability and sensitivity.
Casthouse	Facility converting molten or primary aluminium into semi-finished forms such as billets, slabs, or ingots prior to downstream manufacturing.

5. Traceability Concepts, Data Quality, Disclosure & Confidentiality

Term	Definition
Supply Chain Mapping	Systematic identification of supply chain actors, material flows, facilities and relationships across all tiers for specific products and metals.
Traceability	Ability to follow materials from extraction or recycling through mine of origin through processing, trading and manufacturing to the final product.
Traceability Depth	The furthest upstream tier or control point that can be credibly identified by the supplier.
Mine of Origin (MoO)	Specific mine site where the primary mineral was originally extracted.
Chain of Custody (CoC)	Documented system linking physical material flows with traceability and transactional records.
Batch / Lot	Defined quantity of material produced or handled under uniform conditions and identifiable through documentation.
Aggregation	Mixing of materials from multiple sources, limiting one- to-one traceability, where one-to-one traceability is no longer possible.
Mass Balance	Chain-of-custody model allowing mixing of materials while accounting for certified and non-certified volumes.
Traceability Gap	A break in visibility where upstream actors, locations, processing steps, or material origins cannot be credibly identified.
Origin Declaration	Supplier-provided statement describing the origin of materials at country, facility, smelter, refinery, or mine level (Sheet 4, A1).
Supporting Documentation	Evidence such as MSDS, certificates, transport documents, audit reports, batch references, or ERP records provided to substantiate questionnaire responses.

Smelter-Grade / Refinery-Grade Material	Intermediate material (e.g. alumina, concentrates) suitable for processing at smelters or refineries.
Primary Aluminium / Secondary Aluminium	Primary: aluminium produced from mined bauxite; Secondary: aluminium produced from recycled scrap.
Recycled Content	Proportion of material derived from post-consumer or post-industrial scrap.
Data Confidentiality Level	Classification of information according to its intended level of access, such as private (bilateral), shared (supply-chain partners), or public (regulatory or voluntary disclosure).
Confidential Information	Non-public business, commercial, technical, or supply-chain information shared solely for the purpose of this mapping exercise and subject to confidentiality obligations.
Disclosure Limitation	Legal, contractual, or commercial restrictions that limit the level of detail a supplier can provide (e.g. site-level vs country-level).

6. ESG, Due Diligence & Risk

(supporting OECD language precision and DPP readiness)

Term	Definition
ESG	Environmental, Social and Governance factors relevant to responsible sourcing.
OECD Due Diligence	Ongoing, risk-based process to identify, prevent, mitigate and account for adverse impacts in supply chains.
OECD Five-Step Framework	OECD structure covering management systems, risk identification, mitigation, assessment and reporting.
OECD Annex II Risks	Severe risks including serious human rights abuses, conflict financing, corruption and money laundering.
CAHRA	Conflict-Affected and High-Risk Areas requiring enhanced due diligence.
Risk Identification	The process of identifying actual or potential adverse impacts in the supply chain.
Risk Mitigation	Actions taken to prevent, reduce, or remediate identified risks, including supplier engagement and certifications.
Adverse Impact	A negative effect on human rights, the environment, or governance linked to supply-chain activities.
Upstream Due Diligence	Due diligence activities focused on extraction, processing, and early-stage trading activities, including mine-level and smelter/refinery risks.
Downstream Due Diligence	Risk-based due diligence conducted by manufacturers, assemblers, and brand owners to identify and address supply-chain risks beyond Tier-1 suppliers.
Good-Faith Effort	Reasonable and proportionate actions taken by a supplier to improve traceability, disclosure, and due diligence over time.

7. Reporting Templates & Schemes

Term	Definition
RMI	Responsible Minerals Initiative, an industry initiative providing tools, templates and assurance mechanisms for responsible mineral sourcing.
RMAP	Responsible Minerals Assurance Process – an OECD-aligned third-party audit programme for smelters and refiners.
CMRT	RMI Conflict Minerals Reporting Template for tin, tantalum, tungsten and gold (3TG).
EMRT	RMI Extended Minerals Reporting Template for additional minerals such as cobalt, lithium and nickel.
AMRT	RMI Additional Minerals Reporting Template for minerals not covered by CMRT or EMRT.
ASI	Aluminium Stewardship Initiative standard and certification system for responsible aluminium.
ASI CoC Standard	The ASI Chain of Custody Standard defining requirements for tracking responsibly produced aluminium through the value chain.

8. Digital Product Passport & EU Regulation

Term	Definition
Digital Product Passport (DPP)	A digital, product-linked data set carrying information on composition, origin, sustainability, compliance and lifecycle aspects. DPPs are introduced under the ESPR and will apply progressively to product groups including metals and aluminium.
DPP Public Layer	Means information added to the DPP is available to anyone who can scan the QR code or has access to the public page of the DPP.
DPP Transparent Layer	Means information is only visible to authorised members downstream in your specific supply chain and requires log in details to see it (not public information).
Private Layer	Means information is available only to the immediate recipient and no one else. and it requires login details.
DPP Readiness	The extent to which a supplier can provide structured, machine-readable and verifiable data suitable for future DPP requirements.
Data Reusability	Ability to reuse existing supplier documentation and datasets (e.g. certificates, ESG disclosures) across customers and regulatory requirements.
Machine-Readable Data	Information structured in a digital format that can be processed automatically by IT systems (relevant for future DPP submission).
Lifecycle Information	Data covering multiple stages of a product's life, including material origin, production, use, and end-of-life considerations.

IRBC Agreements	International Responsible Business Conduct Agreements In 2014, the Social and Economic Council of the Netherlands (SER) recommended concluding multistakeholder agreements promoting international responsible business conduct (IRBC agreements) in several sectors.
ESPR	EU Ecodesign for Sustainable Products Regulation (EU 2024/1781), establishing a framework for sustainability and information requirements for products placed on the EU market.
EUBR	EU Battery Regulation (EU 2023/1542), with one of the main requirements being a Digital Battery Passport for EV, LMT and industrial batteries >2kWh from February 2027.
Regulatory Alignment	The degree to which a company's policies, data, and practices are consistent with applicable laws, regulations, and recognised international standards.
Voluntary Initiative	An industry-led or multi-stakeholder programme that supports responsible sourcing or sustainability but is not legally mandatory (e.g. ASI, RMI participation).
Progressive Improvement	Expectation under OECD guidance that companies continuously improve due diligence and traceability over time rather than achieving full compliance immediately.

9. Systems & Disclosure

Term	Definition
Origin Declaration	Supplier-provided statement describing the origin of materials, potentially at country, smelter, or mine level.
ERP System	Enterprise Resource Planning system used to manage purchasing, production, logistics, and traceability data.
Traceability System	Any digital or manual system used to track material flows, including ERP, sustainability platforms, email-based records, or shared drives.
Disclosure Limitation	Legal, contractual, or commercial restriction limiting disclosure details (e.g. site- vs country-level reporting).
Supporting Documentation	Evidence such as certificates, policies, transport documents, or audit reports provided to substantiate responses.

10. Industry Initiatives, Standards & Schemes

Term	Definition
Responsible Minerals Initiative (RMI) / RMAP)	The Responsible Minerals Initiative (RMI) is an industry association providing tools, reporting templates, and assurance mechanisms to support responsible mineral sourcing. The Responsible Minerals Assurance Process (RMAP) is RMI's OECD-aligned third-party audit programme for smelters and refiners, assessing due-diligence compliance and risk management practices.

	Participation may include membership, reporting (e.g. CMRT/EMRT/AMRT), or sourcing from RMAP-conformant facilities.
International Aluminium Institute (IAI)	The International Aluminium Institute (IAI) represents the global primary aluminium industry and coordinates sector-wide sustainability initiatives. IAI provides guidance on GHG accounting, emissions benchmarks, life-cycle assessment (LCA), and climate-related data reporting used across the aluminium value chain.
Aluminium Stewardship Initiative (ASI)	A global multi-stakeholder standards and certification organisation that promotes responsible aluminium production, sourcing, and stewardship across the aluminium value chain. ASI operates the Performance Standard and Chain of Custody (CoC) Standard, which are used to independently verify environmental, social, governance, and responsible sourcing practices.
London Metal Exchange (LME)	The London Metal Exchange (LME) is the world's leading marketplace for industrial metals and the global benchmark price-formation venue for aluminium. The LME operates a Responsible Sourcing Programme requiring all LME-listed brands to implement OECD-aligned due diligence and environmental and health & safety management systems, with disclosures managed through DDPs.
Copper Mark	The Copper Mark is an independently assured responsible production framework covering ESG, governance, and due diligence requirements for copper, lead, zinc, nickel, and associated metals. It is aligned with OECD Due Diligence Guidance and other international standards and may be referenced by companies involved in multi-metal or shared mining and processing operations.
Initiative for Responsible Mining Assurance (IRMA)	The Initiative for Responsible Mining Assurance (IRMA) is a comprehensive and independently assessed standard for responsible mining. IRMA covers social, environmental, business integrity, and community-impact requirements and provides graded assurance levels (50, 75, 100). Participation may include mine-level certification, audits in progress, or sourcing from IRMA-assessed sites.
Extractive Industries Transparency Initiative (EITI)	The Extractive Industries Transparency Initiative (EITI) is a global standard promoting transparency and accountability in the extractive sector. It focuses on disclosure of payments, revenues, licenses, contracts, and beneficial ownership at country level. Participation typically occurs at government or national-programme level but may be referenced by companies operating in EITI-implementing countries.
Global Battery Alliance (GBA) Initiatives (e.g. Battery Passport)	The Global Battery Alliance (GBA) is a multi-stakeholder platform advancing responsible battery value chains.

	GBA initiatives include the Battery Passport, a digital framework for sustainability, traceability, and lifecycle data disclosure for batteries and battery materials. Participation may include pilot projects, reporting alignment, or data contribution.
Aluminium Sector GHG Reporting Initiatives	Sector-specific initiatives and methodologies used to calculate, disclose, or benchmark greenhouse-gas (GHG) emissions associated with aluminium production and processing. Examples include IAI guidance, ISO-aligned methodologies, and recognised LCA or carbon-footprint frameworks used by primary and secondary aluminium producers.
Low-Carbon Aluminium Product Lines	Commercial aluminium product lines marketed based on reduced carbon footprint relative to conventional production, supported by defined methodologies and verification. Examples include RenewAl™, EcoLum™, REDUXA™, ALLOW™, or equivalent branded products. Participation refers to production, sourcing, or resale of such products, not merely purchasing LME-priced aluminium.
OECD Due Diligence Guidance for Responsible Business Conduct	The OECD Due Diligence Guidance for Responsible Business Conduct provides a framework for identifying, preventing, mitigating, and accounting for adverse impacts across global supply chains. Participation may include formal policy alignment, implementation of the OECD Five-Step Framework, supplier due-diligence programmes, or public reporting.