INTERNSHIP REPORT

ON

Scaling or Failing? The Political Economy of Carbon Removal Ventures

By

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I would like to thank Professor David Reiner for his continued support and generous guidance throughout this research project. His expertise in the field is undeniable, and has facilitated me with the skills to think critically about the research question, and beyond.

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Introduction

1.1 Objective of the Internship

The primary aim of this internship was to interrogate the political economy of carbon removal projects, exploring the conditions under which they are deemed to succeed, falter or gain legitimacy. Much existing work on these technologies tend to privilege a uni-dimensional perspective that prioritises a scientific and technical understanding from the chemistry of mineralisation to the physics of direct air capture. This internship distrups this trend, by paying attention to the social, political and economic dynamics that have been for too long left in the background. In this sense, the internship focuses on expanding this definition of 'project success' to capture these determinants – of who finance, who regulates, who verifies, and maybe most importantly, who resists – that shape whether such projects will endure past pilot stages. It places those factors at the centre of analysis, to build a comparative dataset, and develop an interpretative framework through which the unfolding carbon removal sector can be critically assessed.

1.2 Scope and Methodology

The scope of the research encompasses eleven emblematic project, which have been selected the technological diversity of the field, from the direct air capture to ocean alkalinity enhancement and enhanced rock weathering. This dataset reflects the eclectic carbon removal landscape, characterised by variety and early-stage ideas. The data used to fuel this project was collated through a variety of sources, spanning both primary and secondary, including project websites, corporate reports, media investigations and academic commentary. It is important to note that this was limited, by virtue of the infancy of the field, and this necessarily shapes the evidentiary base upon which the present analysis rests. Whilst we proceed with a degree of caution on this basis, it it underscores the late of comparative political economy analysis

Methodologically, the research was anchored in comparative political economy. A structured dataset was constructed, tracing dimensions such as technology type, Techology Readiness Level (TRL), funding, and permanence claims, registry and MRV status, commercial traction. In doing so, the project was able to clarify the landscape through the systematisation of scattered information. In the same vein, a “success index” and “legitimacy index” was devised, facilitating this analysis. This was complemented by stakeholder mapping and investment analysis, intended to illuminate how different actors, corporations, registries, governments, NGOs, and local communities, coalesce or collide in shaping the fate of carbon removal ventures.

Details of Internship Work

The internship was conducted over an eight-week period under the supervision of Professor David Reiner, who is positioned at the Cambridge Judge Business School. Initially, for the first three weeks we met in person weekly/bi-weekly, which then were transferred online, during which discussed we discussed the progress made, re-established weekly goals and addressed any issues that came up.

I started off this internship by attending the Arctic Repair Conference 2025, held at Robinson College, that detailed promising research and tackled debates pertinent to climate engineering in the Arctic. I was able to interact with professionals in the field, and through this gain the wherewithal needed to begin my own reserach on the right foot, aware of the main topic issues and debates. I was especially taken by the discussion by Faatupu Simeti, made on the topic of indigenous knowledge in Tuvalu and how this is often sidelined by scientific discourse. This rang true to Shaun Fitzgerald's opening sentiment that it is "not to do with the physics, but the non-physics" – and this was the underlying basis of my own research project.

I came to this internship, specialising in political science with a longstanding interst in environmental and climate studies, but I had not worked on carbon removal specifically. Thus, in the initial weeks, the focus was on scoping the field and identifying a set of case studies. I was directed to research the history of the field, including some key events such as ScopeX. This allowed me to ground my work in a wider understanding of its background, in which it is embedded. But I feel this did offer me a first-look advantage, which I used to my advantage throughout the process.

Midway through the internship, attention shifted to building a structured dataset and developing an analytical framework. Limitations in this period were twofold: (1) Limitations in unverified claims, and (2) lack of direction. As identified in the introduction, by virtue of the infancy of the field the information and research scope was limited – with some factors requiring an estimate, or taking the self-claimed reports of the company at face value. Whilst I agree that this was indeed limiting in a sense, it is its infancy that makes these hybrid and mosaic conclusions even more important. Secondly, a persistent challenge was navigating the constellation of questions that my initial research prompted – scientific, legal, financial and social – and it was easy to feel pulled in multiple directions at once. The task became not only analytical, but also curatorial: deciding what to foreground and what, inevitably, to leave aside. It required the discipline to prioritise depth over breadth, and hoping to create a more coherent and inscisive project.

The latter weeks were devoted to refining the comparative analysis, visualising findings, and drafting the report.

Conclusion and Learnings

1. Introduction

The latest reports of the United Nations have made clear that whilst global emissions reductions whilst indispensable, have become insufficient in efforts to meet the Paris Agreement's temperature targets. Current 'Nationally Determined Contributions' (NDCs) fall short of what is required, highlighting the urgency of developing carbon dioxide removal (CDR) alongside mitigation. In this context, geoengineering and carbon removal projects are increasingly positioned not as speculative ventures on the fringes of climate discourse, but as necessary complements to decarbonisation. The debate between geoengineering, and nothing, is a fallacy.

Yet the trajectories of these projects are determined less and less by their technical ingenuity, and increasingly by their embeddedness in the political, social and economic worlds in which they exist. The Voluntary Carbon Market (VCM) and a handful of powerful corporate buyers, currently act as the primary engines of investment, shaping which projects succeed and those that fail. In these early stages, the metric of 'success' is fluid: at present, it is viability in the market, underwritten by investment and buyer confidence, and shifting stakeholder constellations. Technologies, once set on a path, acquire momentum, but only where it is legitimised – through measurement, reporting and verification (MRV), through registry certification and through acceptance of investors, regulators and affected communities. Legitimacy, in this sense, it not ancillary to success; it is the basis.

This research is founded on this understanding of success: the ability of a project to establish itself as viable in the short term and credible in the long term. Viability refers to a project's capacity to secure investment, attract buyers, and operationalise its claims; credibility rests on the ability to sustain permanece, achieve verification and withstand contestation. Thus, the guiding research question is:

What political-economic factors determine the success of carbon removal projects, and how do these factors shape their ability to attract investment?

This question reflects both the urgency of market-making in the present, and the anticipation of new government regimes in the future. Whilst UN mechanisms (such as Article 6) and state involvement are likely to become increasingly significant in shaping CDR markets, their influence remains at an early and uncertain level. Following the guidance of Professor David Reiner, I decided to place greater emphasis on the role of investment and private governance in determining project trajectories. By systematising a comparative dataset of 12 carbon removal projects, and analysing their investment practices, MRV practices and legitimacy claims, I seek to illuminate the political economy of an emergent sectors whose importance to climate governance is only set to grow.

1. Conceptual framework

The study of carbon removal projects is often framed in purely technical terms: cost curves, capture efficiencies, or storage capacities. This framing risks obscuring the political and economic forces that ultimately determine whether a project is viable. Hughes (1983) captures this best, in his discussion of large socio-technical systems, and their embeddedness within wider assembaledes of institutions, infrastructures, and actors. Carbon removal is no exception, its trajectory is as much determined by investment flows, and verification systems as by chemistry and engineering.

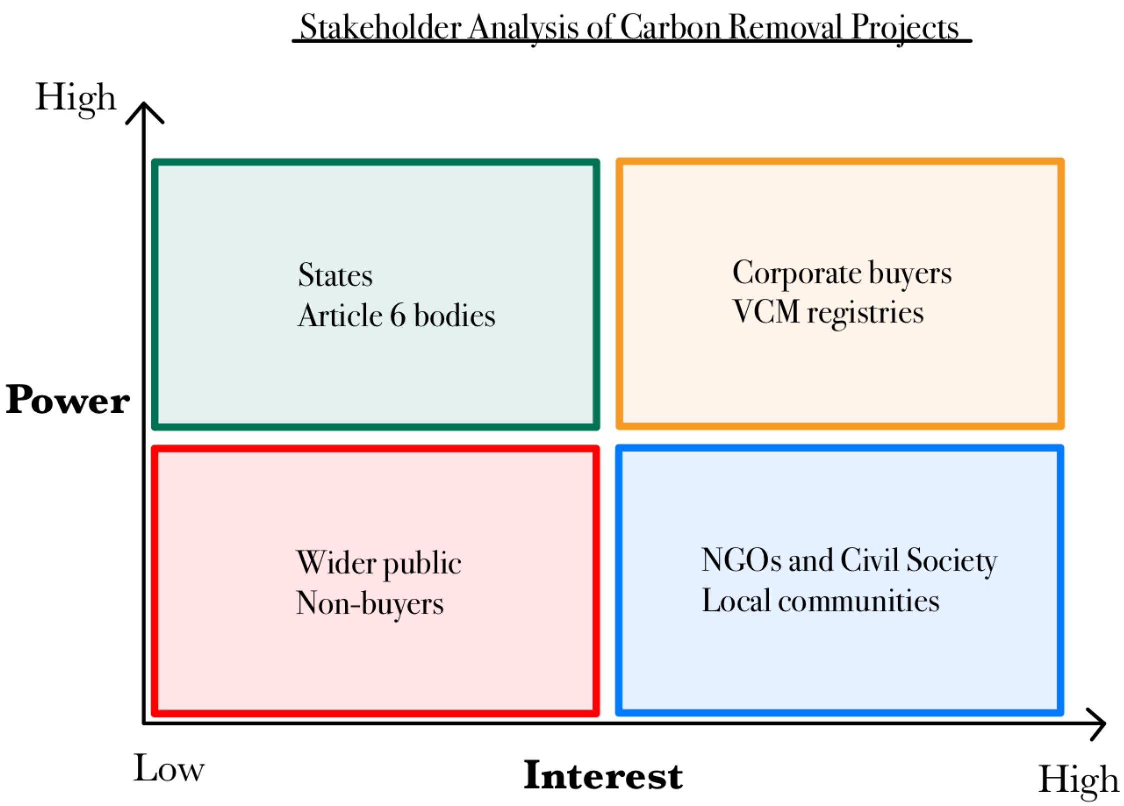
This framework also draws on wider political economy debates about markets as sites of contestation and construction (Callon 1998). Markets do not simply emerge; they are actively built by "system builders," to use Hughes' term, who mobilise resources and institutional support to define rules of participation. The case of carbon removal is one of 'Transnational New Governance,' where the media, corporate buyers, voluntary carbon market registries, and, increasingly, states act as system builders, determine what counts as removal, how permanence is measured, and which projects receive investment. Legitimacy thus becomes both a political and an economic resource - without it, projects struggle to attract capital or scale beyond pilots. But it is clear that as quick as they can gain credibility, they can lose it - this legitimacy is ‘conferred, not given’ and Hughes’ “reverse salients” can quickly unravel this conferred legitimacy.

Against this backdrop, the framework for this research is structured around four interrelated dimensions: technological credibility, market formation, governance alignment, and social licence. These categories provide the analytical scaffolding for the comparative dataset and allow us to examine success as both viability, and credibility. This reflects an understanding, informed by the literature, that the political economy of carbon removal is constituted as much through claims and credibility as through technical efficacy.

2. Stakeholder map

Stakeholder mapping reveals the relationships between stakeholders and potential tensions between “system builders” and “reverse salients”. This stakeholder maps reveals investment as the critical bottleneck of carbon removal proejcts, at this early stage, and thus underscore this key point for this research.

Article 1: Stakeholder map



To understand why investment emerges as the decisive factor in shaping the trajectories of carbon removal projects, it is necessary to map the distribution of 'power' and 'interest' among key stakeholders. Stakeholder mapping offers a way of visualising not only who the relevant actors are, but also how their authority and influence are structured in relation to one another.

The map reveals a striking asymmetry. At this early stage of market formation, corporate buyers and voluntary carbon market registries occupy the quadrant of high power and high interest. Corporate actors such as Microsoft, Stripe andFrontier exercise influence through their purchasing power: their offtake agreements confer a form of 'de facto' legitimacy, determining which projects attract capital and survive beyond the pilot phase. Registries (such as Verra, Puro.earth, and Isometric) operate as gatekeepers, validating MRV practices and thereby enabling credits to be transacted.

By contrast, states and multilateral bodies possess considerable latent power but limited active interest. National governments (through mechanisms such as the US Department of Energy's DAC hubs or the EU's Carbon Removal Certification Framework) and the UNFCCC's Article 6.2 and 6.4 processes are only beginning to exert direct influence. Their eventual involvement could profoundly reshape the field, but for now their impact remains muted compared to private finance.

Civil society actors, NGOs, and local communities are situated in the quadrant of high interest but relatively low formal power. They often bear the direct consequences of deployment, and can mobilise reputational or legal challenges that constrain projects. The case of Running Tide, and the broader controversy over ocean fertilisation, illustrates how public contestation can erode legitimacy even in the absence of regulatory prohibition. The media similarly function as an amplifier of such contestation: while not structurally powerful, investigative reporting (as in the Guardian's exposure of Verra) can rapidly undermine confidence, triggering wider repercussions across the market.

3. Synthesis table

Table 2.1 Synthesis Table SECTION A (Project Basics)

	Factors	Start year	Geography	Type of intervention	Funding	Stage of maturity (TRL)	Trajectory	Current stage
Projects								
SCoPEx		2017	USA; Sweden	Solar Radiation Management (SRM)	Internal Harvard Funds	3	Scalable (air-based)	Failure (public engagement)
Running Tide		2017	Portland, Maine; North Atlantic	Ocean CDR	Shopify, Stripe, Lowercarbon Capital	6/7	Scalable	Failure (financing)
Limenet		2023	Italy; Italy (Augusta, Sicily)	Ocean Alkalinity Enhancement	Core Angels, Aither, Moonstone	7/8	Scalable (modular and closed system)	operational
Seafields		2022	UK; Caribbean	Biomass sinking	Crowdfunding, Awards	4/5	Scalable	operational
SeaO2		2021	Netherland; Netherland	Electrochemical DOC	EU, TU Delft, Wetsus, XPRIZE	5/6	Scalable	operational
Mati Carbon		2021	USA; India, Zambia	Enhanced Rock Weathering (ERW)	Shopify, Stripe, Frontier, XPRIZE	7/8	Scalable	operational
Planetary		2019	Canada; Nova Scotia, Cornwall	Ocean CDR	Shopify, British Airways	6/7	Scalable	Cornwall - failure
Rewind Earth		2022	Israel; Black Sea	Biomass sinking	Propeller, Frontier	6	limited due to the use of waste biomass	operational
Equatic		2021	USA; Singapore, LA	CDR/ Direct Air Capture (DAC)	Hydrogen sales, Chan-Zuckerberg Initiative, Boeing	6/7	Scalable	operational
Climeworks		2009	Switzerland; Iceland	DAC	-	7	Scalable	operational
Vesta		2,019	USA; Caribbean	ERW	Stripe, Investors (Prime Impact Fund)	6/7	Scalable	operational

Table 2.2 Synthesis Table SECTION B (Governance and support)

	Factors	Public engagement	Public acceptance*	Local co-benefits	Government support
Projects					
SCoPEx		No	0 - protests by NGOs, Saami Council and Swedish Government withdrew	No	No - Initial support from Swedish government, withdrawn due to civil society pressure
Running Tide		No	0 - bad media presence (MIT technology review)	Coastal communities livelihoods	No - some research access by Icelandic government
Limenet		Yes - engagement with schools, local community and political figures	3	Job creation, deacidification of ocean, moral redemption	Yes - Municipality of Augusta, Port Authority of Eastern Sicilian Sea, COP29
Seafields		Yes - hotels, industry professionals, Coldplay	4 - Sargassum is a local problem	Feedstock to be used as clean energy source, helps locals	Yes
SeaO2		No	2	Restore local pH balance, assisting the health of marine ecosystems and ocean acidification	Yes - working very closely with EU
Mati Carbon		Yes - 16,000 smallholder partners	2	Very focused on global south, and maximising profits for local farmers	No
Planetary		No	0	No - fishermen displaced	Mixed - government BEIS grant, but local MP backlash
Rewind Earth		No	1 - Little engagement	No direct co-benefits to locals	Mixed - GEOECOMAR, a state backed scientific research institutions
Equatic		No	2	No	No
Climeworks		Yes - media openness, facility tours, direct individual sales	2	No	Yes - Swiss government, and key partner in the Louisiana DAC Hub 2-23
Vesta		Collaboration with locals in Hampton and Dominican Republic	2	Give Back Programmes - work with local community leaders to see what tehy can help with. DR; Sewing Machines	Yes - Federal permit from US Army Corps of Engineers for CDR test

*Public acceptance (0: Active backlash, 1: Little backlash, 2: Neutral, 3: Little support, 4: Active Support)

Table 2.3 Synthesis Table SECTION C (Investment and verification)

	Factors	MRV	Intended scale of of first and future project	Current investment stage	Cost per tonne of CO2	VCM registry status	Claimed permanence	Commercial traction
Projects								
SCoPEx		No	N/a	Seed; $7 million	N/a	N/a	N/a	N/a
Running Tide		Yes - ISO 14064-2	Pilot ~3,600 tonnes / gigaton-scale by mid century	Series B >$70M	Not disclosed but typically charges $250 - $350, according to Bloomberg	None yet	800 years to 1,100 years	Not currently
Limenet		Yes - ISO 14064-2 and Web3, blockchain	Pilot ~150kg total/ 100,000 tones/year	Seed ~$2.7M in 2023 in early stage SAFE	$600 per tonne	Yes - Carbonmark direct credits	Stable between 10,000 and 100,000 years'	Most notably 1000 tonnes of credits to KlimaDAO, $500,000 Frontier prepurchase round
Seafields		No - still in the planning stage	Future scale: 1 gigatonne per year	Seed £2.9M (as of March 31, 2025)	$246 per tonne - reduced by side product	None yet	Remineralisation at surface of the ocean = '900 years'	Not currently
SeaO2		Yes - Internal	First project intended: 250 tonnes; Future scale: 1 gigatonne per year	Seed €2M, aiming for €20M Series A by 2026	Not disclosed, DAC tech estimated around $230 - $630	None yet	>10,000 years of permanence	Klarna pre-purchase funding at $2.35 million USD, Ledgy purchase 6 tCO2
Mati Carbon		Yes - verified by YCNCC	Intended yearly scale: 10,000 tonnes; Future scale: 1 Gigatonne	Seed	Around $300 per tonne (trellis.net)	Unclear	>10,000 years	Selling credits to Frontier and Shopify
Planetary		Yes	Future scale: 1 Gigatonne	Series A $11.35M	$1600 (2023, cCarbon.info)	Yes - Isometric registry	100,000 years	World's first verified OAE credits (625.6 tCO2) prepurchased (11)
Rewind Earth		Yes - Internal	Pilot 20 tonne, projected 50,000 - 100,000 tonne per project	Seed $5M	$300	Unclear	Hundreds to thousands of years	Not currently
Equatic		Yes - ISO 14064-2:2019	109,500 tonnes projected	$11.6MM (Closed Series A funding round on 11th AUG 2025)	$400-$1,300	Unclear	>10,000 to billions of years, depending on the form of (bi)carbonate	60,000 credits to Boeing
Climeworks		Yes - Internal	900 tonnes (Capricorn 2017)/ "could easily do a gigaton in the future"(8)	Series D $1B	$1000	Puro Standard	Depends on the method' - from decades to hundreds and thousands of years	40,000 -Ton deal with Morgan Stanley (10)
Vesta		Yes	>10,000 tonnes/100,000+ million tones	Series A	$1000	None yet	"Tens to hundreds of thousands of years"	Yes - Stripe pre-purchase

Table 2.4 Success and Legitimacy Index

Success index

1. Funding diversity
   a. 0 = no major investors/pre-seed
   b. 1 = some VC or corporate interest/seed
   c. 2 = multiple strong backers (Microsoft, Stripe, government, VC)/ series A+
2. Registry/MRV status
   a. 0 = none
   b. 1 = internal/pilot/unclear/ISO
   c. 2 = third-party verified (Verra, Gold Standard)
3. Technological maturity
   a. 0 = lab or early stage pilot
   b. 1 = small-scale deployment
   c. 2 = commercial facility operating/scaling
4. Commercial traction
   a. 0 = none
   b. 1 = internal/ small volumes
   c. 2 = active sales/advance purchase agreements

Legitimacy index

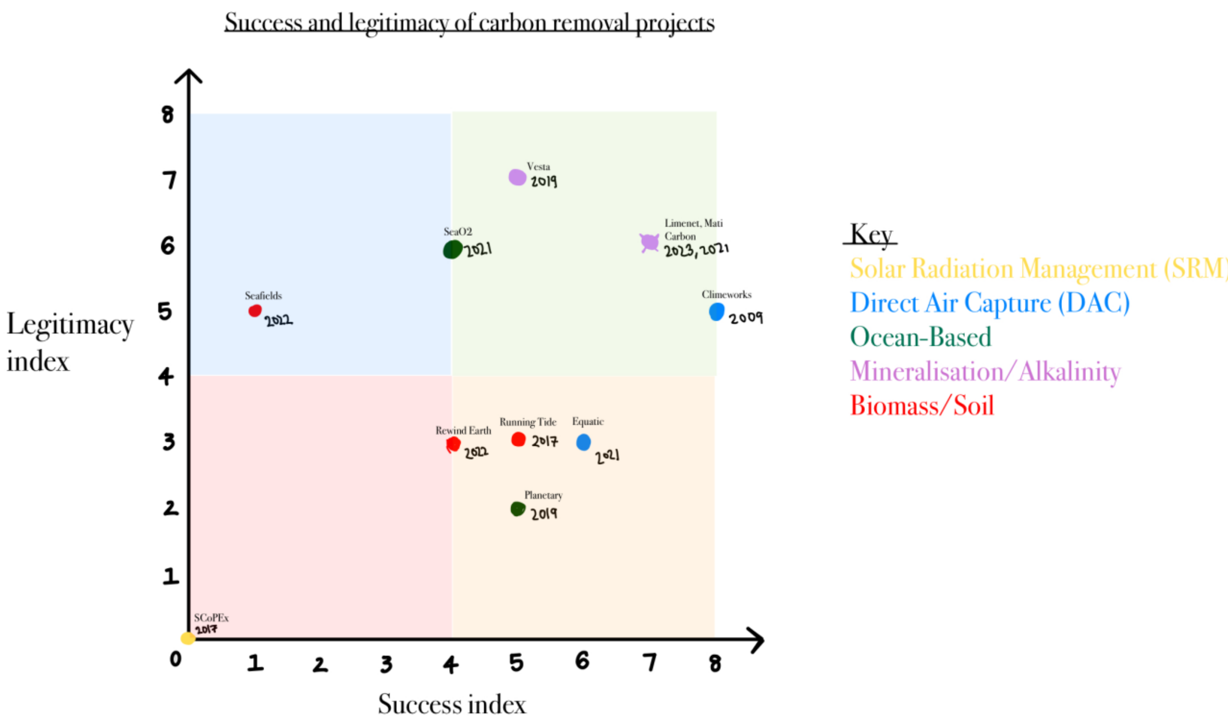
1. Permanence claim credibility
   a. 0 = vague/untested
   b. 1 = 100-1,000 years
   c. 2 = >1000 years with clear MRV pathway
2. Policy & State engagement
   a. 0 = no engagement
   b. 1 = some state interaction/climate law relevance
   c. 2 = explicit government funding
3. Public reputation
   a. 0 = widely criticised
   b. 1 = mixed/uncertain
   c. 2 = broadly positive recognition
4. Equity & co-benefits
   a. 0 = ignores/avoids scrutiny
   b. 1 = neutral/minor co-benefits
   c. 2 = strong co-benefits (jobs, biodiversity, South-South partnerships)

Projects	Success index	Legitimacy index
SCoPEx	0	0
Running Tide	5	3
Limenet	7	6
Seafields	1	5
SeaO2	4	6
Mati Carbon	7	6
Planetary	5	2
Rewind Earth	4	3
Equatic	6	3
Climeworks	8	5
Vesta	5	7

The two conceptual elements, 'success' and 'legitimacy,' are essential when considering the research question. Often conflated with one another to mean the same thing, the analysis of the projects through the success and legitimacy index – and comparing the two figures show that the most legitimate are not necessarily the most successful (e.g Vesta, SeaO2) using our metric. Whilst they can intersect the long-term viability of carbon removal projects, technical progress alone does not guarantee legitimacy, or vice versa. SCoPEx, for example, demonstrated strong scientific development but collpase under public and political opposition, while Climeworks has combined demonstrable removal capacity with transparent verification to achieve both high success and legitimacy. Ocean-based projects such as Running Tide and Seafields illustrate the fragility of legitimacy when transparency and ecological uncertainties remain unresolved, with moderate technical advances offset by reputational challenges. Conversely, projects like Equatic demonstrate how early alignment with governments and robust MRV frameworks can elevate both indices simultaneously, positioning them for commercial scaling. The index therefore underscores that successful projects are those that manage to balance technological feasibility with institutional trust and public legitimacy, and that imbalances - whether high success with low legitimacy, or high legitimacy without demonstrable performance ultimately hinder long-term sustainability. It also highlights the importance of financing, which determines and shapes 'success' on the basis of corporate interests, rather than purely on the basis of legitimacy. But rather the financing of carbon removal startups creates the illusion of a performative 'legitimacy'. In this sense, the project seeks to analyse the VCM, but also to map corporate investment which is dominated by a few.

It is also very interesting to note that all of the projects in this sample come after in the 2020s boom (see Article 2.1), in the timeline of carbon removal history. This can be broken down into 4 main sections (1) Early Foundations (1970s-2000s) - first academic discussions, Kyoto Protocol CCM (compliance carbon markets), (2) Experimental Phase (2000s) – Ocean Iron Fertilisation Experiments (LOHAFEX, Planktos, etc.), Royal Society Report on Geoengineering, popularisation of research, (3) Breakthrough of Carbon Removal (2010s) – Paris Agreement, IPCC Report, Stripe launches carbon removal purchases, (4) Scaling (2020s) – Microsoft commits $1B to climate innovation and negative emissions. The proliferation of these startups begins in this phase, where the economic incentive and uncrowded market provide a fertile basis for profit and growth. This highlights best the influence of corporations on the market - by creating the economic incentive that inspires these startups, but it is this inherent capitalistic desire to grow and gain the most investment that is the downfall of many of these companies. Companies often over-promise their capacity in order to secure contracts, pursue rapid scaling before their technologies are technically or socially robust, and in some cases collapse under the weight of unmet expectations. This dynamic illustrates a potential 'principal-agent' problem: buyers such as Microsoft seek credible long-term removals to meet climate pledges, but start-ups, as agents, may exaggerate performance or downplay risks to attract funding, creating a misalignment between the buyers' long-term interests and the sellers' short-term survival strategies. The result is a market that is both catalysed and distorted by corporate demand, with significant implications for the stability and legitimacy of the sector.

Looking at Article 2.2 Governance and support, reveals that institutional backing and stakeholder engagement are critical determinants of project trajectories. Projects with strong government support, such as Equatic and SeaO2, have benefited from this regulatory alignment which has enabled them to progress in a more streamline manner. By contrast, projects that failed on this front such as ScoPEx, demonstrate this vulnerability. Although, the industry is not central to most national climate policy or initiative – it is definitely something that could shift in the future, as this becomes more focal. The table also highlights the importance of publci engagement: initiatives like Seafields and Limenet actively sought these partnerships with local communities and co-benefits for livelihood. Whilst this it is important, the effect of Sargassum o daily and tourist life and ''Quadrilatero della morte" problem , respectively, may have been the main reasoning for this – rather than the support for carbon removal. This puts into the scalability of carbon removal projects rather than taking for granted this cultural, social and political idiosyncrasies of populations.



The quadrant scatterplot provides a powerful lens through which to interpret the balance between technical success and social legitimacy across carbon removal projects. The upper-right quadrant, shaded green, represents projects that combine higher levels of both dimensions. This includes Climeworks, Equatic, and mineralisation ventures such as Vesta and Mati Carbon, which have managed to scale technically while maintaining credibility through transparency, MRV, or government support. These cases illustrate the profile of projects most likely to achieve long-term viability.

By contrast, the upper-left quadrant (blue) highlights projects like Seafields, which achieve moderate legitimacy - often through community engagement or perceived ecological co-benefits - yet remain technically constrained. These initiatives risk plateauing unless technical performance improves. The lower-right quadrant (orange) is particularly telling: projects such as Running Tide and Planetary demonstrate technical promise and funding traction but suffer from weak legitimacy, reflecting a vulnerability where scaling outpaces public acceptance and governance alignment. Finally, the lower-left quadrant (red) is populated by cases like SCoPEx, where both technical and legitimacy deficits converge, underscoring how quickly projects can fail without institutional or societal foundations.

Overall, the visual makes clear that few projects achieve strength across both axes simultaneously, and that technical maturity without legitimacy, or legitimacy without performance, ultimately limits scalability. The quadrant framing therefore provides an analytical tool to distinguish not only where projects stand, but also the risks and conditions under which they may succeed or fail.

4. VCM, Corporations, and Forward-Looking Analysis

The Voluntary Carbon Market (VCM) is an decentralised market in which carbon credits – that may represent one tonne of C02 avoid, reduce or removed – are traded. Buyers, like Microsoft may use these to offset their own emissions or to demonstrate climate leadership, even when they are not legally required to do so. The lack of legal obligations has meant that in recent times, a few corporations dominate the market – most notably, Microsoft, Stripe, Frontier and Shopify. Whilst the VCM acts as a testing ground for new methodologies (e.g. ocean alkalinity, biomass sinking), the standards of these dominating corporations also shape the structure that a lot of these startups take. In order to maximise their grounds for success, their pertain to ideas, and concepts that have worked well for other carbon removal projects. Increasingly so, this has been focusing on the verification of their carbon removals, and MRV becomes a primary focus for these corporations. With a rise of greenwashing claims, and the Guardian's expose of Verra, corporations become politically inclined to verify their carbon emission reductions.

Whilst most of the projects are technically legitimated, by upholding ISO standards, which provide the methodologies and rule for the MRV. Projects that have secured this verification e.g Climeworks, Equatic and Mati Carbon, enjoy a stronger position: their credits carry greater credibility, command higher prices, and attract institutional buyers such as Microsoft, Stripe and Frontier. By contrast those that have secured only partial MRV e,g Running Tide, Rewind Earth are far more exposed to reputational and financial risks, as credits issues in unstandardised formats are increasingly scrutined for quality. This divergence reflects a structural issue in the VCM, whilst it does lower the barriers for entry by allow startups to monetise early, it also produces this credibility gap that can undermine investor confidence.

This contributes dearly to the instability of the voluntary carbon market, and creates a space which is limited in growth as it is positioned as a high risk investment.

Most are not verified by registries, which issue, record and track carbon credits protecting against double counting. Registries such as Verra, Gold Standard, and Puro.earth provide the infrastructure of the market in this sense. Table 2.3 illuminates how projects like Climeworks and SeaO2, which are linked to established registries, are therefore able to translate removals into tradeable assets that buyers can recognise and trust. The synthesis shows how the distinction between the two can shape project positioning. The most competitive projects are those that combine both rigorous ISO-based verification plus registry integration – which not only reduce reputational risk but also secures access to premium buyers in the VCM. These projects such as Climeworks and SeaO2 tend to have more ambitious intended scales and clearer pathways to commercialisation. Permanence is also higher in these cases: they both claim century-scale storage which is consistent with registry requirements that demand durability and safeguards against reversal. As a result, these projects also demonstrate stronger commercial traction, securing multi-year contracts with corporate buyers and institutional investors. It is clear that registry participation is a stronger diffferentiator, and it is likely that this gap will widen as the VCM converges with evolving Article 6 standards that look to standardise methodologies and bridge voluntary and compliance markets, in efforts to raise these standards.

As stated in the introduction, this current analysis is liminal, and hence limited to this specific period of time. It is important, thus, to look forward and see how these conclusions may shape the future but also how it may be changed. The upcoming COP30, may change the landscape altogether, as Article 6 rules are operationalised the Roel of states in governing carbon removal projects is set to expand significantly. It is true that corporations and investors have shaped the type of carbon removal project that has hitherto succeeded, but Article 6 may require an icnreased state involvement including authorisation, national reporting and alignment with

NDCs. This means that states may shift to the position of central gatekeepers, and thus it will be those projects that may be well-positioned to thrive in the new era of carbon removal projects.

5. Conclusion and reflections

When reflecting upon what could have gone better during this internship, I think to the structure of the process. This internship has taken an arc-like trajectory, which has allowed for an increasingly narrow research objective. It has culminated in looking specifically at the role of corporations, investments and how the 'voluntary' element of the carbon market impacts startup behaviours i.e projecting scalability orders beyond their capacity. Whilst the development of the project was a very natural one, I feel that a more structured aim for the internship may have narrowed down the possibilities much earlier, cultivating the possibilities for more fruitful analysis. As well as this, it could have provided much more structure for the type of project this was, which was primarily online. This could have been supplemented with reading more academic scholarship on themes such as the financialisation of the environment, legitimacy, and previous technological advancements like this one. If I had had more time, I would have liked to have looked further into this to build a stronger conceptual framework.
As a primarily independent research project, this has been a very personally formative experience. It allowed me to explore various different directions that this project could have gone in before narrowing it down. Whilst, this was at times a struggle, it allowed me to understand the context of the field at a much deeper level. This was also supplemented by the weekly calls with my internship supervisor. It was useful to have online zoom sessions to keep the project on track, and get some feedback on certain ideas – especially due to the nature of it being online. I am grateful for this opportunity, and hope that it can provide a basis for which other work can be done.

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