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Performing legitimacy in electric aviation: The innovation journey of Heart Aerospace

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ABSTRACT

The decarbonisation of aviation is a major challenge in the global pursuit of sustainability, with aircraft operations contributing around 3 % of global carbon dioxide emissions. Electric aviation offers a promising response, combining the potential for zero-emission flight with revitalised short-haul and regional markets through low-cost, point-to-point operations. However, its development faces major obstacles, including technological immaturity, infrastructural lock-ins, regulatory complexity, and uncertain consumer acceptance. In this context, legitimacy—the perceived appropriateness of an emerging technology within established social, institutional, and technical contexts—becomes a vital precondition. This paper examines how legitimacy is enacted through the interplay of discursive and material practices, conceptualised as sociomaterial legitimation. Drawing on a longitudinal case study of Heart Aerospace, a Swedish electric aircraft start-up, the analysis traces how narratives, artefacts, and actor-networks interact to build and maintain legitimacy over time. Using media analysis, participant observations, and documentary sources, the paper shows that legitimacy is not merely constructed through discourse but materially performed through prototypes, demonstrators, and choreographed public events. These findings advance an understanding of sociomaterial legitimation in sustainability transitions and offer practical insights for policymakers and industry actors working to support emerging technologies under conditions of uncertainty.

1. Introduction

The decarbonisation of aviation is a critical challenge in the global drive for sustainability transitions, with the flying and operation of aircraft contributing approximately 3 % of global carbon dioxide emissions [1,2]. Industry actors are pursuing a range of transition pathways, many of which centre on technological innovation such as advanced biofuels and hydrogen-based propulsion systems [3,4]. Amongst these, electric aviation has emerged as a promising solution—offering the potential for zero-emission flight alongside a revitalisation of short-haul and regional air markets through low-cost, point-to-point operations [5,6].

However, the aviation industry's entrenched routines, stringent safety requirements, and high entry barriers create significant inertia, making the successful development and deployment of electric aviation fraught with challenges, including technological immaturity, infrastructural lock-ins, regulatory hurdles, and unknown consumer acceptance [7–9]. Within such a context legitimacy—the perceived appropriateness and desirability of an emerging technology within established social, institutional, and technical systems—is a critical precondition for innovation [10,11]. Emerging technologies that challenge established norms and routines—such as electric aviation—are difficult for actors and stakeholder to grasp, offering benefits that may not be immediately tangible, and often tend to encounter considerable scepticism [12]. Thus, emerging technologies must overcome the 'liability of newness' [13] and "be considered as appropriate and desirable by relevant actors in order for resources to be mobilised, for demand to form and for actors […] to acquire political strength" [14].

In the context of sustainability transitions, legitimacy has been examined in various context such as renewable and nuclear energy [15–17], water [11,18], and electric vehicles [19,20]. Although such studies acknowledge legitimacy as an outcome of collective action rather than a property of individual actors [11,14], they often conceptualise it as a relatively stable state achieved through institutional embedding. This framing tends to privilege discursive processes, focusing on how actors deploy language, narratives, and rhetorical strategies to frame their activities as morally and socially acceptable whilst deflecting negative associations [21]. Less attention has been paid

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to the performative processes through which legitimacy is continually constructed and contested, recognising that the world is in constant becoming, constituted through evolving relationships, situated practices, and ongoing interpretations [22,23].

This discursive emphasis, whilst valuable, risks overlooking how legitimacy is also performed through other modes [24]. As Hoppmann et al. [25] observe, the way a technology is framed as legitimate "depends on the characteristics of the framed technology – i.e., its empirically observable, material properties and evolution over time." In the development of new technologies, this interplay becomes especially significant: actors often construct legitimacy through the display of material artefacts such as prototypes, technical drawings, and physical models [26], as well as through performative acts including demonstrations and pilot projects [27].

A deeper understanding of how material factors inform legitimacy is therefore important for advancing scholarship in sustainability transitions where technology is often a central focus of change in societal systems such as energy and mobility [28]. In this context, prototypes, demonstrators, and pilot projects are not passive representations of technological progress; rather, they are actively deployed by actors to shape perceptions, build commitments, and mobilise the resources necessary for scaling innovation. In highly regulated and materially entrenched sectors such as aviation, these artefacts do more than symbolise potential—they exert agency by anchoring narratives in tangible forms and by shaping what stakeholders perceive as feasible, desirable, and inevitable [29,30]. Despite their significance, existing scholarship has rarely examined how these material dimensions intersect with discursive strategies to sustain—or destabilise—legitimacy over time [25].

To address this gap, this paper proposes the concept of *sociomaterial legitimation* for the analysis of legitimacy to illustrate how it emerges through the dynamic entanglement of discursive and material practices. This concept extends prior work on legitimation rooted in organisation and management studies [13] building on a review by Vaara et al.'s [31] which synthesises scholarship on discursive legitimation and identifies five key elements for analysing legitimation processes: strategies, positions, foundations, arenas, and temporalities. Extending this work, I integrate the concept of materiality, acknowledging that the physical form and properties of a technology can actively shape and support processes of legitimation [25,32]. As Leonardi and Barley [33] argue, "the material properties of artefacts are precisely those tangible resources that provide people with the ability to do old things in new ways and to do things they could not do before." From this perspective, artefacts are not passive backdrops to social action, but active mediators that shape how legitimacy is constructed, enacted, and sustained over time.

I illustrate the concept of sociomaterial legitimation, by drawing on a longitudinal study of sustainable in Sweden, focusing on the case of Heart Aerospace. In line with Sweden's national goal of achieving carbon neutrality by 2045 [34], the Swedish aviation industry is exploring a range of alternative aircraft fuels and technologies to mitigate the climate impact of aviation [3,35]. Against this backdrop, Heart Aerospace has emerged as a pioneering start-up with the aim of delivering "the fastest, cheapest, and most environmentally friendly means of regional transport and exporting it to all corners of the world" [36]. Founded in 2018, the company initially set out to develop a 19-seat all-electric aircraft (known as ES-19) for commercial release by 2025. However, it has since twice revised its timeline and design, pivoting in 2022 to a 30-seat hybrid-electric model (known as ES-30) with a revised launch target of 2028 [37], and later relocating to the United States [38]. Despite these shifts—often viewed as moments of vulnerability for emerging technologies—Heart Aerospace has managed to construct and maintain legitimacy. This is evidenced by its securing over USD 130 M in funding and 250 firm orders from airlines and leasing companies worldwide[1] [39].

The case of Heart Aerospace illustrates how legitimacy for emerging technologies and their proponents is co-constructed through the dynamic entanglement of discursive and material practices. Visionary narratives are repeatedly anchored in tangible displays of progress—including prototypes, demonstrators, and choreographed public performances—that enrol stakeholders and stabilise expectations. This makes Heart Aerospace an illuminating case for examining sociomaterial legitimation in action, particularly within a highly regulated and materially entrenched sector like aviation.

By introducing the concept of *sociomaterial legitimation* that foregrounds how legitimacy is enacted through the entangled performance of material and discursive practices, the paper demonstrates how artefacts such as prototypes, demonstrators, and anchor events materially stabilise narratives, enrol stakeholders, and structure expectations over time. Empirically, it shows how legitimacy is distributed across actor-networks and anchored in spaces and events that fuse visionary discourse with tangible technological milestones in the innovation journey of Heart Aerospace. Theoretically, it extends discursive approaches to legitimation by incorporating insights from organisational studies to examine how material artefacts actively co-constitute legitimacy. In doing so, the paper reframes legitimacy as a dynamic, performative process shaped by iterative interactions between artefacts, narratives, and institutional structures—opening new avenues for analysing the contested and path-dependent nature of innovation for sustainability.

In the following section, I develop the concept of *sociomaterial legitimation* by first reviewing how legitimacy has been examined within sustainability transitions research, then turning to discursive perspectives and advancing the case for integrating materiality. Section 3 outlines the empirical case and methodological approach. Section 4 presents a detailed analysis of how legitimacy was enacted in the case of Heart Aerospace. Section 5 discusses the practical implications and theoretical contributions of the study, whilst Section 6 concludes by reflecting on its limitations and identifying directions for future research.

2. Theoretical background

In the social sciences, legitimacy is commonly defined as "a generalized perception or assumption that the actions of an entity are desirable, proper, or appropriate within some socially constructed system of norms, values, beliefs, and definitions" [13]. From this definition, legitimacy is not inherent to individual actors or organisations but emerges through collective action as actors seek to align their activities with prevailing "rules, values, norms, and definitions" [40]. This has been taken up in various literatures from sociology, political science, management and organisation studies.

2.1. Legitimacy in sustainability transitions

In sustainability transitions research, legitimacy has been identified as a critical factor shaping the emergence, scaling, and institutionalisation of new technologies [41]. Much of this work has been situated within the analytical framework of technological innovation systems, where legitimacy is a key system function that enables new technologies to overcome their 'liability of newness' [13] in contexts such as biogas

[1] As of July 2025.

[10], water [11], and wind [42].[2] Although such studies recognise legitimacy as the result of collective action rather than the property of individual actors [11,14], they often treat it as a relatively stable condition achieved through institutional embedding. Understood by Markard et al. [10], legitimacy is "a commonly perceived alignment (or misalignment) of a focal technology with institutional structures in its context." [14].

This framing tends to privilege discursive processes, focusing on how actors deploy language, narratives, and rhetorical strategies to frame their activities as morally and socially acceptable whilst deflecting negative associations [21]. For example, Binz et al. [11] show how proponents for potable water reuse in California deployed positive framing and educational campaigns to normalise the technology, positioning themselves as community allies and drawing on environmental responsibility narratives. Markard et al. [10] illustrate how local residents in Germany destabilised the legitimacy of biogas projects by framing them as environmentally harmful, adopting roles as 'protectors of the landscape,' and using media platforms as arenas for contestation. Similarly, Weström [15] describes how community groups in Orkney legitimised wind-to-hydrogen systems by appealing to local narratives of resilience and place-based identity whilst engaging in governance struggles over decentralised energy systems.

The tendency to conceptualise legitimacy in discursive terms parallels developments in organisation studies, where legitimation is often framed as a fundamentally communicative process [43]. Whilst this perspective has yielded important insights into the social construction of legitimacy, it risks underplaying the role of material artefacts, infrastructures, and embodied practices in these processes. As Hoppmann et al. [25] argue, the material properties of a technology shape how it is framed just as much as framing shapes the development of the technology itself. Recognising these dynamics calls for a broader analytical lens, which the next section begins to develop by reviewing discursive legitimation and its core elements.

2.2. Discursive legitimation

The emphasis in legitimacy as a largely discursive process in sustainability transitions echoes the "linguistic turn" in organisation studies, which conceptualises legitimacy as a social process of 'legitimation' [44]. Studies often examine how language and communication practices shape perceptions of [31,43], examining rhetorical strategies of persuasion [102], framing processes [45], narrative construction [46], and the role of ideological discourses in legitimacy struggles [47]. From this perspective, legitimation is understood primarily as a communicative endeavour, a process of 'discursive legitimation' [31].

As a process, legitimation has been defined by Deephouse and Suchman [48] as a dynamic phenomenon and "the process by which legitimacy of a subject changes over time" and encompasses "stakeholders' actions to endorse or contest an organisation's legitimacy as well as the organisation's actions to defend itself" [40]. Building on this, Vaara et al. [31] conducted an integrative review that synthesised scholarship on legitimation, particularly focussing on how actors mobilise discourses, narratives, and rhetorical strategies to shape perceptions of their actions as positive, ethical, comprehensible, and acceptable—whilst simultaneously deflecting associations with harm or scepticism [21]. Their analysis identified five key elements of discursive legitimation—strategies, foundations, positions, arenas, and temporalities—that together offer a comprehensive framework for examining how legitimation is constructed, maintained, and contested over time.

Discursive strategies refer to the rhetorical and linguistic tools actors deploy to reinforce, challenge, or transform perceptions of legitimacy. For example, rhetorical strategies of persuasion often draw on the Aristotelian tradition of rhetoric—*ethos* (credibility), *pathos* (emotions), and *logos* (reasoning)—to analyse how actors construct persuasive claims [49]. *Discursive positions* capture the roles, identities, and subjectivities actors adopt in engaging with or influencing legitimation processes. In struggles for discursive legitimacy, dominant actors often control the content, structure, and processes of discourse to privilege certain objects or subjects as legitimate [40]. These positions are in turn shaped by *discursive foundations*: the ideological frameworks [47], shared assumptions [50], and cultural narratives [51] that underpin and stabilise legitimacy claims. The temporal and spatial dimensions of legitimation are captured in the remaining two elements. *Discursive temporalities* refer to the ways in which legitimacy is constructed and contested over time, highlighting the iterative and dynamic nature of these processes [48]. *Discursive arenas* encompass the communicative spaces—media platforms, policy forums, public events—where legitimacy struggles unfold and are made visible [31].

Together, these five elements foreground critical questions for analysing discursive legitimation: how legitimacy is constructed (strategies), who engages in or contests it (positions), what it rests upon (foundations), when it emerges or shifts (temporalities), and where it is negotiated (arenas), summarised in Fig. 1. However, whilst this framework richly captures the linguistic and rhetorical dimensions of legitimation, it leaves open the question of how material artefacts, infrastructures, and embodied practices actively participate in these processes—a gap that this paper seeks to address through the concept of sociomaterial legitimation, which I present in the next section.

2.3. Towards the concept of sociomaterial legitimation

The concept of *sociomateriality* is rooted in organisational studies[3] that seek to understand how technologies and organisations co-constitutes one other through practice [32,52]. As a concept, it recognises that actors and artefacts are inseparably linked: every tool, technology, and space arises from social processes and, in turn, shapes social action. As Orlikowski [32] explains,

> "the social and the material are considered to be inextricably related—there is no social that is not also material, and no material that is not also social."

This perspective highlights that technologies are not merely passive carriers of functionality; rather, they possess a form of agency—a capacity to shape action—that is both embedded in and emergent from social practices [53,54]. The materiality[4] of a technology affords possibilities for action that enables or constrains human (social) agency. Importantly, these affordances are not fixed but are perceived and enacted differently across contexts [55].

In the context of legitimation, sociomateriality acknowledges that technologies do not gain legitimacy through discursive means alone but are "bound up with materiality" [32]. Materiality plays an integral role in this process, as the physical properties of artefacts provide "precisely

[2] 'Legitimation' is one of seven system functions of the technological innovation systems framework together with 'knowledge development and diffusion', 'influence on the direction of search', 'entrepreneurial experimentation', 'market formation', 'resource mobilisation', and 'creation of positive externalities' [14].

[3] Whilst materiality has been explored in various fields such as actor-network theory (e.g., [99,100]) and posthumanism (e.g., [101]), with each offering unique perspectives on the relationship between the social and the material, this paper primarily draws from organisation studies, where sociomateriality has been a central focus, particularly through the work of authors such as Wanda Orlikowski, Susan Scott, and Paul Leonardi.

[4] I draw on Leonardi's [55] definition of materiality as "the arrangement of an artefact's physical and/or digital materials into particular forms that endure across differences in place and time and are important to users." From this definition, I understand that whilst the material form of an artefact may remain stable, its meanings and uses are always shaped through social interpretation.

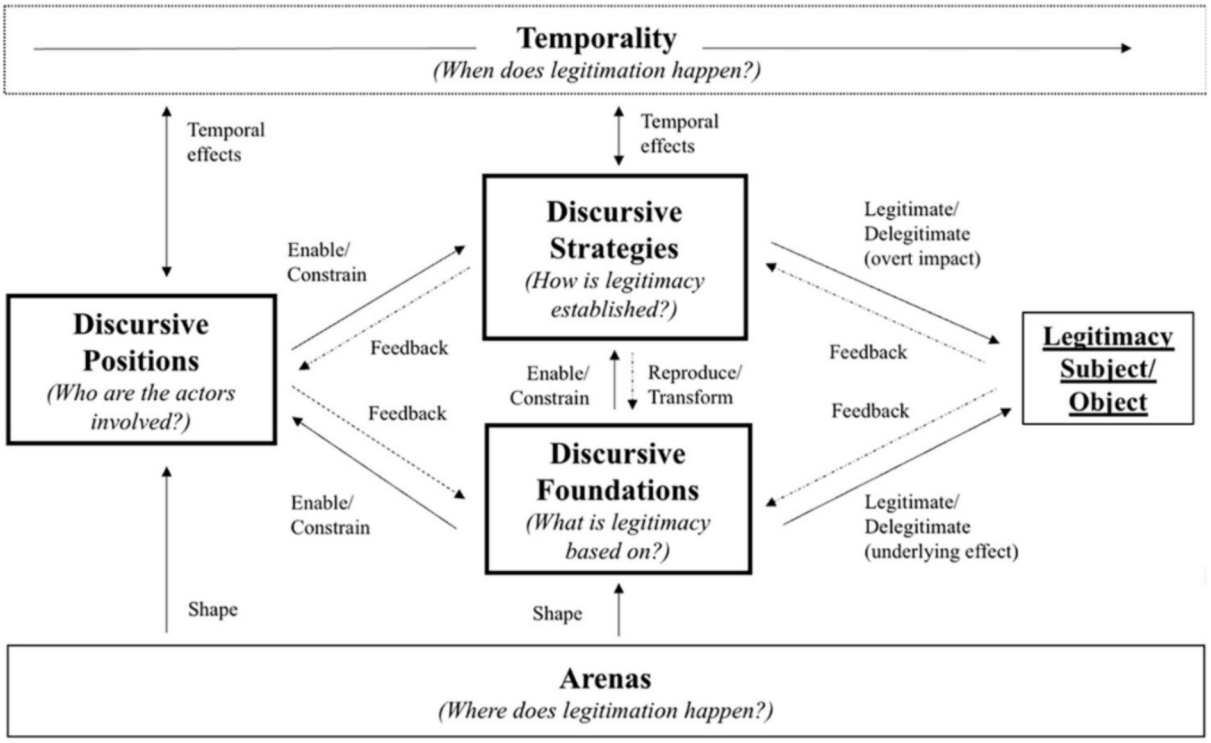

Fig. 1. Integrative theoretical framework on discursive legitimation. Figure reproduced from Vaara et al. [31].

those tangible resources that enable people to do old things in new ways and to do things they could not do before" [33]. Sociomaterial legitimation thus shifts attention away from legitimacy as a static outcome of discursive strategies and towards the situated practices through which it is enacted [32,55]. These practices may be discursive, through rhetorical framing, storytelling, or deployment of persuasive narratives, and/

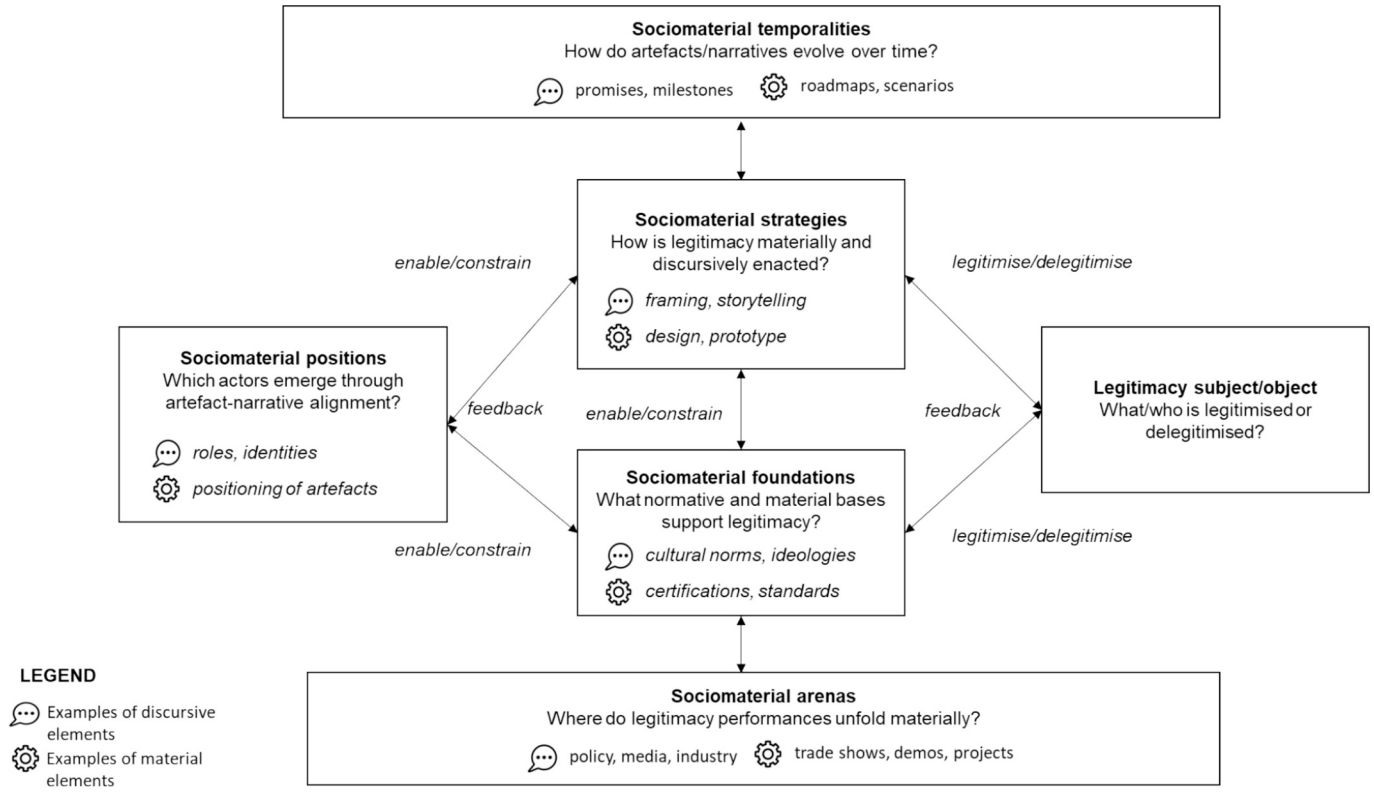

Fig. 2. Sociomaterial legitimation, extendings Vaara et al.'s (2024) discursive model by incorporating material dimensions across six interrelated elements. Legitimacy is enacted through sociomaterial strategies, positions, and foundations, shaped by evolving temporalities and arenas, and directed towards specific legitimacy subjects or objects. Arrows indicate mutual influence and dynamic feedback between artefacts, narratives, and legitimacy claims.

or material in nature, involving the design, display and mobilisation of artefacts like prototypes, demonstrators, testbeds, and visualisations that render technological futures tangible and actionable.

This perspective is particularly salient in the development of new technologies. Beyond discursive and rhetorical framing, actors often engage in material practices to construct and stabilise legitimacy. These include the specification, production and display of artefacts such as prototypes, technical drawings, and physical models [26], as well as performative acts like demonstrations and pilot projects [27]. From this perspective, legitimation is not a fixed state achieved through institutional embedding [10] but a dynamic, performative process shaped by evolving relationships, situated practices, and ongoing interpretations [22,23].

To develop the concept of sociomaterial legitimation, I integrate materiality into Vaara et al.'s [31] five-element framework by integrating materiality, recognising that the physical forms, affordances, and properties of technologies actively shape and support legitimation processes [25,32]. This extension, visualised in Fig. 2, highlights how discursive and material practices are constitutively entangled across these five analytical dimensions.

Sociomaterial strategies refer to the ways actors deploy material artefacts—prototypes, business models, demonstrators—alongside rhetorical tools to reinforce, challenge, or transform perceptions of legitimacy. *Sociomaterial positions* encompass the roles, identities, and subjectivities enacted through the alignment of artefacts and narratives, such as firms positioning themselves as innovators via public unveilings of working prototypes. *Sociomaterial foundations* underline how claims to legitimacy are anchored not only in ideological and normative frameworks but also in material evidence embedded in scientific reports, technical standards, and physical infrastructures. These three elements are dynamically interrelated: material artefacts and discourses mutually enable and constrain each other, shaping how positions and foundations are constructed and contested. This process unfolds within temporal and spatial contexts. *Sociomaterial temporalities* foreground how artefacts and narratives evolve over time—becoming symbols of progress, obsolescence, or contested futures—as legitimacy is iteratively performed. Finally, *sociomaterial arenas* highlight the material and digital settings where legitimation struggles play out—conference halls, hangars, factory tours, test flights, and online platforms—embedding discursive practices within tangible infrastructures and public performances. Together, these five dimensions illuminate how legitimacy emerges as a performative process shaped by iterative interactions between discourses, artefacts, and institutional arrangements.

3. Case selection and methods

3.1. Case selection

Having developed the concept of sociomaterial legitimation, I now turn to the case of Heart Aerospace to illustrate how legitimacy is enacted through the entanglement of discursive and material practices. The aviation industry offers an interesting context for such an inquiry. Deeply entrenched routines, stringent certification requirements, and formidable entry barriers mean that actors must not only deliver technological innovation but also mobilise extensive actor-networks spanning global supply chains, regulatory authorities, and local infrastructures [7,8]. In this setting, legitimacy is not a fixed attribute but a distributed and emergent property, co-constructed through ongoing efforts of diverse stakeholders—airlines, airports, regulators, policymakers, and prospective passengers—each with their own ambitions and goals that both shape and are shaped by the emerging technology [53,56].

Heart Aerospace was established in late 2018, following a Swedish research initiative which assessed the feasibility of electric aviation from April 2018 to January 2019 [57]. At its inception, the company articulated an ambition to transform regional air travel by developing the ES-19, a 19-seat all-electric aircraft targeted for commercial release in 2025 [58]. Since then, Heart Aerospace has undergone two major timeline revisions and, in 2022, announced a significant design pivot to the ES-30, a 30-seat hybrid-electric model now planned for launch in 2028 [37], and later relocating to the United States [38]. Such pivots often represent moments of fragility for emerging technologies, exposing them to heightened scrutiny and potential erosion of stakeholder support [59]. Yet Heart Aerospace has successfully maintained and expanded its legitimacy, as evidenced by securing over USD 130 million in funding and 250 firm orders from airlines and leasing companies worldwide—alongside options and letters of intent for hundreds more [39]. These developments make Heart Aerospace an illustrative case for examining how sociomaterial practices anchor visionary narratives, stabilise expectations, and mobilise resources in the face of technological and institutional uncertainty.

My interest in Heart Aerospace emerged from my broader engagement with sustainability transitions in the Swedish aviation industry. Since November 2020, I have been immersed in the field—conducting interviews with industry actors, attending industry events, and hosting workshops as part of a wider research project. Over this period, I became increasingly aware of Heart Aerospace's growing prominence as a perceived leader in sustainable aviation, despite lacking a market-ready product and undergoing several major design changes.

In July 2022, I contacted the company for an interview and was subsequently invited to their Hangar Day event that September. At this event, I observed the public announcement of the design pivot from the ES-19, a fully electric 19-seater, to the ES-30, a larger hybrid-electric aircraft [37]. The shift entailed increased technical complexity and a delayed timeline, yet what stood out was the enthusiastic stakeholder response—marked by applause and vocal support—which contrasted with the potential vulnerability such a redesign might signal. This experience prompted me to reflect on how Heart Aerospace and its supporters maintained and even reinforced perceptions of legitimacy despite the absence of a commercially viable product. I was particularly struck by the company's skilful use of material artefacts—prototypes, digital renderings, and demonstrations—as resources to anchor evolving narratives and justify the strategic shift. This observation became the starting point for a deeper investigation into how materiality supports the construction and maintenance of legitimacy amidst uncertainty.

3.2. Methods of data collection and analysis

The study focuses on publicly available data, appropriate for examining public performances of legitimacy [27,60]. Data collection focused on reconstructing Heart Aerospace's innovation journey as a longitudinal study, tracing key events, strategic pivots, and public representations [61,62] (see Appendix A). Whilst reliance on public sources limits access to internal organisational processes and contested perspectives, it provides rich insights into how legitimacy is constructed and maintained in spaces where emerging technologies are performed, narrated, and made tangible for diverse audiences.

First, I gathered media articles from the media archive Retriever. An initial search conducted in 2025 used the string ((“electric aircraft” OR “electrical aeroplane”) AND “Sweden”) identified 730 articles published between 1 January 2018 and 31 December 2024. To refine the dataset, I excluded articles focusing on general aviation sustainability, military applications, or unrelated forms of electromobility. This process yielded 147 articles directly addressing commercial electric aircraft, with relevance determined from headlines and lead paragraphs. Following Heart Aerospace's announcement of its full relocation to the United States in April 2025, I conducted a supplementary search for “Heart Aerospace”, which returned 24 additional articles focused on the company's transition between 1 January 2025 to 5 May 2025. Together, these 171 articles form the core of the media dataset, capturing how Heart Aerospace was represented, received, and reframed over time.

Second, I revisited recordings of company-staged events known as

Hangar Day from 2020, 2022, and 2024, which are publicly available on YouTube. I transcribed the full recordings of the 2022 and 2024 events (each approximately 1 h in duration) and supplemented these with an 11-min highlights video form 2020. My analysis of the 2022 Hangar Day was further enriched by field notes from my in-person attendance, offering additional insights into the event's performative aspects and audience responses.

Third, I incorporated additional sources to enrich and triangulate the analysis. These included official documentation released by Heart Aerospace—such as press releases, investor updates, and technical specifications—alongside independent media reports, government policy documents, and industry commentaries. Together, these materials offered insights into how legitimacy was constructed not only by the company itself but also distributed across a wider network of actors, including policymakers, regional stakeholders, and industry advocates. This triangulation enhanced the robustness of the case history and illuminated the interplay between company-led narratives, external validations, and institutional discourses in sustaining momentum for electric aviation.

After establishing the case history [61], I analysed Heart Aerospace's innovation journey using an abductive coding strategy, iteratively moving between theoretical concepts and empirical material [63]. This approach allowed for the refinement of existing ideas on discursive legitimation whilst integrating insights on materiality drawn from the data. I focused particularly on episodes where material artefacts and discursive narratives became entangled—moments where prototypes, demonstrations, and technical specifications intersected with visionary narratives to enrol stakeholders, stabilise expectations, and navigate disruptions. Guided by the sociomaterial legitimation framework developed in this paper, the analysis identified patterns across the five sociomaterial elements, i.e., strategies, positions, foundations, arenas, and temporalities.

In the next section, I present the analysis of the case by tracing the four key phases of Heart Aerospace's innovation journey. Each phase is examined to show how legitimacy was materially and discursively constructed, highlighting the evolving alignment between narratives, artefacts, and institutional contexts. This longitudinal perspective enables a deeper understanding of how sociomaterial legitimation unfolds over time, and how legitimacy is maintained, challenged, or reconfigured at critical junctures in the innovation process.

4. Analysis

This analysis traces the sociomaterial legitimation of Heart Aerospace through four analytically defined phases of its innovation journey: Taxiing (2018–2020), Take-off (2020−2021), Turbulence (2022−2023), and *Re*-routing (2023–2025). Drawing on the concept sociomaterial legitimation, the analysis highlights how Heart Aerospace continuously aligned narratives, artefacts, infrastructures, and institutional expectations to mobilise support and navigate uncertainty. Each phase is examined in terms of how discursive strategies and material resources interacted to produce legitimacy—or expose its fragility—within specific arenas and actor-networks. The result is a longitudinal perspective on how emerging firms in sustainability transitions perform legitimacy not only through what they say, but through what they build, display, modify, and abandon.

4.1. Taxiing – establishing sociomaterial legitimacy in a Nordic context (2018–2020)

Heart Aerospace founded in late 2018, emerging as a spin-off from the ELISE[5] research project by founder and CEO Anders Forslund [57]. From the outset, its legitimation strategy was predominantly discursive with a vision "*to build the fastest, cheapest, and most environmentally friendly means of regional transport and export it to all corners of the world*" [58]. This resonated strongly with the Swedish aviation industry, anchored in a material foundation of national competences and infrastructures, drawing on the country's legacy of aeronautical expertise, network of regional airports and airstrips, and abundant low-carbon electricity production capacity. These resources, whilst not at the time mobilised for electric aviation, afforded a realistic geographical scale for the envisioned innovation and situating Heart Aerospace's aspirations within a familiar institutional and material landscape. As the CEO noted, "*We have a big advantage in Sweden… one of the few countries in the world that has the opportunities to produce certified aircraft*" [64].

In the spring of 2019, Heart Aerospace secured USD 2.1 M in venture capital funding having participated at the start-up accelerator Y-Combinator [65]. This investment provided the company not only with legitimacy as a start-up but also translated into physical premises established at Säve airport, just outside Gothenburg on the west coast of Sweden in September 2019—demonstrating an early conversion of discursive credibility into tangible presence within the Swedish aviation industry [66].

Crucially, Heart Aerospace's initial discursive strategy did not overstate its technological ambitions. The company openly acknowledged the limitations of contemporary battery technologies and framed its aircraft within achievable boundaries:

> "It is not possible, in the near future, for electric flights to fly across the Atlantic or to Thailand, but regional routes—Stockholm to Visby, Östersund to Trondheim, or Gothenburg to Copenhagen—are ideal" [67]

This careful alignment of narrative and material constraints helped Heart Aerospace enrol local actors. As one regional actor observed:

> "The electric aircraft's current estimated radius of action and function fits well into our geographically elongated region and could drastically reduce travel times between the region's nodes, creating a better basis for business, culture and public cooperation in the region" [68]

Support from regional actors was not only discursive by also through their activities taking the form of network-coalitions and feasibility projects (see Fig. 3 for an overview). Technological specifications—even before taking physical form—acted as a projected materiality that both afforded and constrained actors agency. The ES-19's proposed 400 km range defined a technological horizon within which regional planning and experimentation could occur, whilst simultaneously limited broader imaginaries of electric aviation's potential. Heart Aerospace's decision to design a 19-seater aircraft was strategic, aimed at accelerating time-to-market in line with the 2025 timeline. As the CEO explained:

> "If we had chosen 20 passengers, it would have been classified as a different type of aircraft and taken five to ten years longer to certify" [69]

This technological framing was itself shaped by regulatory materialities in the form of certification. Certification rules did not act as passive externalities but actively shaped the technology's trajectory. In the initial phase, narratives and certification became entangled, establishing legitimacy through a vision of regional revitalisation and by mobilising key material resources—funding, premises, and personnel.

[5] ELISE is an acronym of *Elektriskt Luftfart i Sverige* ('Electric Aviation in Sweden') and was funded by Vinnova, the Swedish Innovation Agency and ran from April 2018 to January 2019.

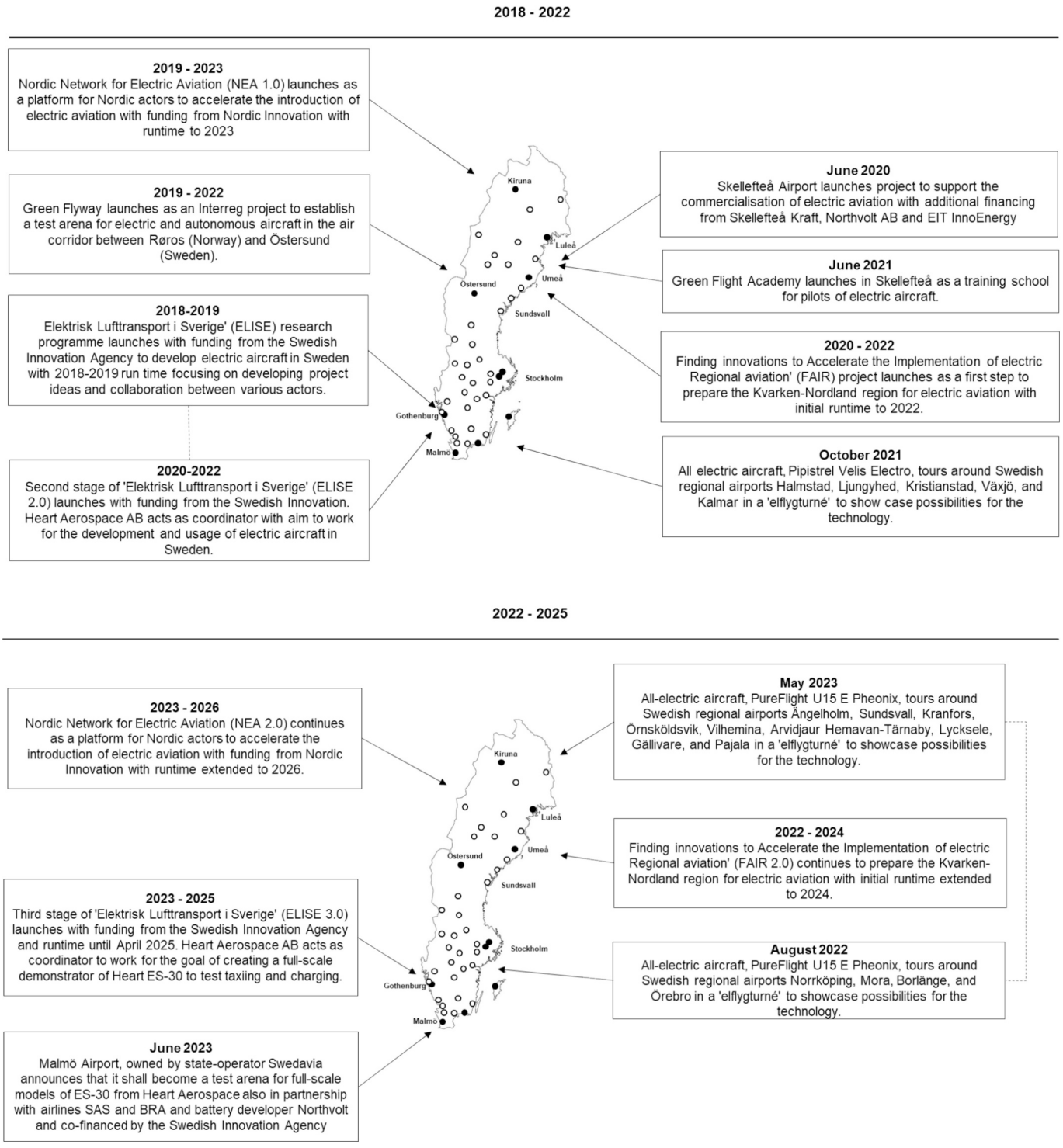

Fig. 3. Overview of activities led by regional actors between 2018 and 2022, and 2022 and 2025. Arrows indicate the locations of central actors, plotted in relation to airports. Dark circles represent state-owned airports; white circles represent regionally owned airports. Author's own image.

4.2. Take-off – building momentum through stage sociomaterial anchoring (2020–2021)

Heart Aerospace entered a new phase of sociomaterial legitimation in 2020, when the company convened its inaugural Hangar Day [70]. Bringing together approximately 30 high-profile actors from across the Nordics, including HRH Prince of Sweden and the Swedish Minister of Infrastructure. This event functioned as a performative arena where Heart Aerospace could demonstrate tangible progress towards its ambitious vision anchoring narratives in prototypes, digital simulations, and physical displays.

A key discursive strategy during this phase was the deliberate comparison to existing aircraft models, embedding Heart Aerospace's vision within familiar aviation networks and tempering perceptions of risk. By aligning their aircraft with established designs like the De Havilland 'Dash' series, Heart Aerospace positioned itself as pragmatic rather than revolutionary:

> "It is very similar to a lot of other aircraft like the Dash 7 and Dash 8 that you'll see all over the world. We're doing this because we don't want to reinvent the wheel. We know what's successful from the past and can use modern tools to make it as efficient as possible" [70]

This pragmatic framing was reinforced by material performances. Digital renderings combined with physical prototypes—such as motor assemblies and aerodynamic simulations—transformed Heart Aerospace's vision from abstract promise into tangible reality (see Fig. 4). This strategy captivated stakeholders, making electric aviation appear both feasible and imminent. As Sweden's Minister of Infrastructure remarked at the event: *"Ten years ago, we probably didn't think this was possible"* [71].

The event also marked a shift in Heart Aerospace's source of legitimacy. Whereas earlier narratives centred on the CEO, Anders Forslund, as a visionary entrepreneur, Hangar Day showcased the collective expertise of a growing team. Presentations by engineers—many with prior experience at established companies such as Saab[6]—reinforced Heart Aerospace's organisational competence and credibility. This repositioning was crucial for engaging regulators, investors, and partners, signalling that Heart Aerospace was no longer just an experimenting start-up but a legitimate actor within Sweden's aviation industry. This resulted in Heart Aerospace securing USD 35 M in Series A funding, led by Breakthrough Energy Ventures, United Airlines Ventures, and Mesa Air Group in July 2021. Significantly, both airlines placed firm orders for 200 ES-19 aircraft, with options for an additional 100 planes [72,73].

Meanwhile, efforts to legitimise Heart Aerospace extended beyond the company. In 2021, Svenska Regionala Flygplatser ('Swedish Regional Airports') organised a demonstration tour of electric aviation using a smaller two-seater electric aircraft [74]. Whilst smaller in range and capacity compared to the ES-19, the initiative was explicitly framed as a precursor to Heart Aerospace's vision:

> "With the ES-19, Swedish regional airports could be crucial for the future of electric aviation in Sweden" [75]

This tour aimed to raise public awareness, embedding electric aviation in the distributed networks of actors and airports, supporting Heart Aerospace's legitimacy.

At the end of 2021, Heart Aerospace achieved another milestone with the successful flight of its 1:5 scale ES-19 prototype, first unveiled at Hangar Day in September 2020. This material demonstration served as a powerful performative device, validating technical claims and sustaining stakeholder confidence:

> "This test flight validated what we already knew—that the ES-19 aerodynamic design is inherently stable and safe" [76,77]

In this phase, sociomaterial legitimation was no longer confined to Heart Aerospace's narrative construction but was enacted through distributed practices and artefacts that progressively stabilised expectations across a growing network of stakeholders.

4.3. Turbulence – pivoting and re-anchoring sociomaterial networks (2022–2023)

In 2022, Heart Aerospace entered a period of turbulence as it announced a major redesign of its flagship aircraft. This redesign altered the technical specifications that had previously galvanised regional actors and networks around the ES-19. At the 2022 Hangar Day, Heart Aerospace revealed it would no longer pursue the 19-seat, all-electric aircraft. Instead, it announced the development of a 30-seat hybrid-electric model, the ES-30 (see Fig. 5). Whilst the new design extended the aircraft's range by 400 km and expanded its potential market appeal, it also delayed commercialisation by two years to 2028 [37].

This pivot was discursively framed as a strategic necessity, aligning with Heart Aerospace's expanding global ambitions. During the opening presentation at Hangar Day, the CEO reflected on the evolution of the company's to date:

> "We created the 19-seater ES-19 aircraft certified under EASA CS 23 to be tailor-made for the market in the Nordics. But as we made this announcement, we started hearing from airlines all over the world... what we started as a local niche product had a global appeal. But to make an aircraft that could fly everywhere, the ES-19 needed to change" [78]

Rather than framing this as a rupture of earlier commitments, Heart Aerospace positioned the redesign as a natural outcome of success—an adaptation driven by growing global interest. This reframing shifted Heart Aerospace's foundations of legitimacy from a regional and Nordic focus to one of global relevance. At the same time, the company acknowledged that material constraints—such as weight categories and certification standards—necessitated a rethinking of design priorities to enable operation in diverse contexts. Heart Aerospace did not discard its earlier work. Instead, it discursively anchored the ES-19 as *"the culmination of all our engineering efforts throughout the last years"* [78], presenting the redesign as a narrative of continuous learning and technical maturation.

This narrative was bolstered by endorsements from external actors with the announcement of an Industrial Advisory Board comprising global airlines, aircraft lessors, and airport operators [78].[7] Members of this strategic network spoke publicly in support of Heart's revised trajectory:

> "We have every confidence that the team at Heart Aerospace has the expertise to deliver on the ES-30 and its promise of a cleaner and greener aviation future" [78]

> "…thanks to the work being done by the team at Heart, and the vision and dedication of my friend Anders, we can see that reality as early as 2028." [78]

Material artefacts also played a central role in supporting the redesign with the unveiling of the 'Integrated Test Facility', a full-scale test rig that simulated the newly announced 30-seater aircraft's systems as a single unit. As Heart Aerospace's Chief Engineer explained:

> "We have essentially built an entire aircraft on the ground. We can already touch and feel and even fly this aircraft" (Chief Engineer, at Hangar Day 2022).

The test facility embodied Heart Aerospace's technical progress and mitigated concerns over the shift to hybrid-electric propulsion. Attendees were invited to engage with the test rig—donning hard hats, exploring a cabin mock-up, and interacting directly with Heart's engineers. This choreographed participation transformed Hangar Day into an arena of legitimacy, reinforcing collective confidence in Heart Aerospace's revised trajectory. By the end of 2022, Heart Aerospace had secured 230 new orders, underscoring the effectiveness of its strategy in navigating disruption and re-anchoring legitimacy across an expanded global actor-network [79].

[6] Saab AB is a Swedish aerospace and defence company primarily operating from Sweden, founded in 1937.

[7] The 2022 Industry Advisory Board included Aerus, Air Canada, Air New Zealand, Braathens Regional Airlines, CDB Aviation, Cebu Pacific, Christchurch Airport, DAT, Icelandair, London City Airport, Mesa Air Group, Republic Airways, Rockton, SAS, Sevenair, Sounds Air, Swedavia, Toki Air, United Airlines, Vmo Aircraft Leasing and Wellington Airport.

Fig. 4. Digital rendering of the ES-19, as presented at Hangar Day 2020. (Figure reproduced from Heart Aerospace.)

4.4. Re-routing – strategic repositioning and the fragility of sociomaterial networks (2023–2025)

Since the announcement of the ES-30, Heart Aerospace's legitimacy has been repeatedly tested across multiple arenas with the company's plans for scaling production facing challenges that exposed the fragility of its legitimacy.

At the 2022 Hangar Day, Heart unveiled its plans for a production facility—dubbed the Northern Runway—at Säve Airport. Envisioned as a site capable of producing up to 120 ES-30 aircraft annually by 2028, the Northern Runway symbolised Heart Aerospace's commitment to anchoring production locally whilst scaling globally [37,78]. However, by February 2023, these plans faltered as the company announced it would no longer proceed with the Säve airport site, citing infrastructural and financial barriers:

> "Since we announced that we would establish ourselves at Säve Airport, the market situation has changed and the necessary investments that the airport needed to make to renovate the runway are no longer possible." [80]

Here, the materiality of the runway itself shifted from being a symbol of regional renewal to an active constraint, reshaping Heart Aerospace's strategic options. What was once a celebrated site of localised production became a locus of vulnerability, underscoring how embedded infrastructures can simultaneously stabilise and destabilise innovation activities. Although local disappointment was tempered by pragmatic resignation amongst stakeholders: *"Things like this can happen in this type of business"* [80].

In February 2024, Heart secured an additional USD 107 million in Series B funding, reinforcing its activities and signalling continued global investor confidence [81]. Yet this moment of stability was quickly followed by organisational turbulence within Sweden. Weeks later, the company announced redundancies for one-third workforce [82], framing it as a strategic realignment to consolidate hybrid-electric system expertise:

> "We have to make sure that we have the skills we need. Not all people do the same things." [83]

Unlike the Northern Runway cancellation, these layoffs provoked unease amongst local stakeholders, exposing tensions between Heart Aerospace's public narrative of progress and the lived experience of organisational instability. As one local actor noted: *"It has been a bit rushed and went a bit too fast at the beginning"* [83]. The workforce reduction became a material rupture that eroded the discursively constructed image of distributed technical competence and collective momentum.

The organisational turbulence deepened. In May 2024, Heart Aerospace announced the relocation of part of its research and development team to the United States. Framed as a strategic response to regulatory and infrastructural realities, this move was presented as preparation for "*a new phase of hardware testing*" [84]. The CEO sought to reassure Nordic audiences that the company as a whole would not relocate:

> "No, we are not moving the company... our long-term goal is to have production facilities in Europe, the US and other parts of the world such as Asia." [85]

The Hangar Day in September 2024 once again became a critical arena for coordinating stakeholders, positioning the distributed workforce as a *"multi-national team"* [86]. Speakers from both Sweden and the United States divisions presented updates on the company's progress, including the newly appointed U.S.-based CTO who introduced the X1—a fully electric demonstrator aircraft—as a tangible embodiment of

Fig. 5. Digital rendering of the ES-30, as presented at Hangar Day 2022. (Figure reproduced from Heart Aerospace.)

Heart's hybrid-electric ambitions made possible by the relocation of research and development to the US (see Fig. 6). As the CTO explained:

> "We are not looking to innovate for the sake of innovation, but for a purpose, and our purpose is to get the job done." [86]

However, the company later announced the full relocation of the company to the US in April 2025 [38]. Presented as a pragmatic response to global market realities, the company justified the move by emphasising its proximity to key stakeholders:

> "Our largest customers such as United Airlines and Air Canada, most of our investor base and the entire subcontractor chain are here. At that time, it was difficult to put together a business plan to build it in Sweden." [87]

A reversal of an earlier commitment to Sweden, the material relocation marked a profound shift in Heart Aerospace's foundations and positions of legitimacy. The initial narrative of Swedish competence and regional commitment was overwritten by a new discourse of globalism and market alignment and in doing so, both the material and discursive elements of Heart's sociomaterial networks were reconfigured, exposing the fragility of legitimacy in the face of shifting institutional and infrastructural landscapes.

5. Discussion

To illustrate the process of sociomaterial legitimation, this paper has examined the case of Heart Aerospace, revealing how legitimacy for emerging technologies is co-constructed through the dynamic entanglement of discursive and material practices. In this case, visionary narratives have been and are consistently anchored in tangible displays of progress—material artefacts such as prototypes, demonstrators, and carefully choreographed public performances—that not only enrol stakeholders but also mobilise resources and stabilise expectations over time. In doing so, Heart Aerospace engaged in what Garud et al. [88] describe as *path creation*, where agency is not concentrated in individual actors but emerges through distributed networks of people, artefacts, and practices. This distributed agency reflects the performative nature of socio-technical change, as legitimacy materialises from the ongoing interactions and alignments amongst narratives, technologies, and institutional arrangements [27].

In its early stages, Heart Aerospace's legitimation strategy centred on discursive framing. The company positioned its innovation as a direct response to Nordic climate goals and mobility needs. This narrative resonated within the established infrastructures and routines of the aviation industry, leveraging Sweden's legacy of aeronautical expertise and its dense network of regional airports across the Nordic region [35].

Initially, the founder and CEO embodied the role of the visionary entrepreneur, acting as the primary figurehead in articulating Heart Aerospace's ambitions and mobilising early support. Over time, however, legitimacy became increasingly distributed across a broader network of regional and national actor. These networks demonstrate how sociomaterial legitimation extended beyond the focal company itself to encompass collaborative projects, demonstration tours, and testbed initiatives. Notably, technical specifications served as a form of projected materiality, becoming a tangible reference point for planning, affording opportunities for local experimentation whilst simultaneously

Fig. 6. Photograph of X1 demonstrator in ground support procedures tests at Säve Airport in early September 2024. The tests were completed as part of the third stage of 'Elektrisk Lufttransport i Sverige' (ELISE 3.0), funded from the Swedish Innovation Agency and runtime until April 2025, with the goal for creating a full-scale demonstrator of Heart ES-30 to test taxiing and charging. Heart Aerospace AB acted as coordinator to the project.
(Figure reproduced from Heart Aerospace.)

constraining broader imaginaries of the technology's future [55].

Through the dynamic entanglement of material and discursive elements, Heart Aerospace has adeptly navigated what Garud et al. [59] term the *paradox of legitimacy*. Entrepreneurial narratives, whilst critical for mobilising support, simultaneously create expectations about technological milestones, market entry, and policy alignment. These expectations impose temporal pressures and dependencies across actor-networks, which, if unmet, can erode legitimacy and trigger stakeholder disengagement [59]. This risk is particularly acute in emerging industries where progress is non-linear and contingent on the coordination of diverse social, technical, and institutional elements [89]. In such contexts, the failure to secure legitimacy can set off a downward spiral, as early withdrawals of support limit resources for meeting remaining expectations, thereby amplifying losses of legitimacy [89,90].

Heart Aerospace have mitigated these risks by consistently anchoring its evolving narratives in tangible artefacts and performative events. Key amongst this has been the biennial Hangar Day gatherings which have emerged as critical *anchor events*, carefully choreographed arenas where material artefacts—prototypes, test rigs, and digital visualisations—were interwoven with visionary discourses [27]. These events functioned as temporal and spatial focal points for Heart Aerospace's sociomaterial legitimation, enabling the company to enrol new actors, sustain momentum, and manage uncertainties. As Ruttan [91] suggests, such events provide entrepreneurs with platforms for pitching ideas to diverse audiences, facilitating the formation of actor-networks and supporting temporal coordination. They also create opportunities for 'critical revisions' [92] when narratives and expectations are recalibrated in response to technological complexity and institutional constraints [62].

Notably, Hangar Days proved pivotal during moments of strategic change, such as the design pivot from the ES-19 to the ES-30 in 2022 and the partial relocation to the United States in 2024. At these junctures, the physical presence of prototypes and demonstrations—combined with carefully crafted discourses—materialised Heart Aerospace's promises, making the future of electric aviation feel tangible and imminent. Legitimacy was thus not only communicated discursively but enacted through embodied practices that sustained alignment across diverse actor-networks and reinforced the firm's position within an evolving socio-technical regime. Much like business models [93], Heart Aerospace's prototypes and demonstrators operated as performative devices—projecting credibility and enabling stakeholders to envision, assess, and commit to an emergent technological field. These artefacts, when paired with the presence of high-status actors and intertextual ties to parallel technological or market developments [94], contributed to the formation of a shared field identity [95]. As Polkinghorne [96] suggests, such "gestalts" emerge when discursive and material elements are integrated into a coherent narrative, reinforcing the perceived inevitability of a specific innovation pathway.

The Heart Aerospace case highlights how sociomaterial legitimation processes offer crucial insights for policymakers seeking to foster innovation to accelerate sustainability transitions. Tangible artefacts and performative events—whilst often led by companies—benefit from supportive institutional infrastructures that can anchor emerging technologies domestically. In highly regulated and path-dependent sectors like aviation, gaps in policy frameworks can undermine these

sociomaterial networks, as seen in Heart Aerospace's eventual relocation to the United States.

Although Heart Aerospace independently organised events such as Hangar Days, Garud et al. [27] suggest that governments and regional bodies can play a more active role in convening such anchor events. Conferences, expos, and demonstration days provide vital platforms for entrepreneurs to build networks, enrol diverse stakeholders, and coordinate innovation activities across fragmented ecosystems. In highly regulated sectors like aviation, such governmental engagement can be decisive in retaining emerging industries and their associated innovation networks domestically [3,7]. Heart Aerospace's relocation to the United States highlights the risks of governmental passivity. The company explicitly cited a lack of legislative and institutional support from the Swedish state as a key factor behind this strategic shift. This underscores how gaps in policy frameworks—whether in funding, infrastructure, or regulatory alignment—can compel innovation companies to seek more favourable environments abroad, resulting in lost opportunities for local industrial development and climate leadership.

This concept of *sociomaterial legitimation* extends prior work on discursive legitimation rooted in organisation and management studies [13] and is increasingly applied within innovation systems and sustainability transitions research [41]. Building Vaara et al.'s [31] synthesis of discursive legitimation—which identifies five analytical elements: strategies, positions, foundations, arenas, and temporalities—this study integrates the concept of materiality to expand the framework. This extension recognises that the physical form and properties of a technology are not passive backdrops but actively shape and support legitimation processes [25,32]. By incorporating material artefacts such as prototypes, testbeds, and infrastructures, the analytical framework developed here offers a richer lens to examine how legitimacy is enacted: who the key actors are, what legitimacy rests upon, when legitimation unfolds, and where it becomes anchored. This sociomaterial perspective foregrounds how agency emerges from the dynamic interplay of discourses, artefacts, and institutional arrangements—an iterative process of alignment and contestation that simultaneously enables and constrains legitimation [53,97].

This paper contributes to the literature on legitimation in sustainability transitions, which has largely emphasised discursive perspectives [11,16]. Whilst such studies recognise legitimacy as the outcome of collective action rather than a property of individual actors [14], they often conceptualise it as a relatively stable state achieved through institutional embedding [10]. This framing privileges discursive processes, focusing on how actors deploy language, narratives, and rhetorical strategies to frame their activities as morally and socially acceptable whilst deflecting negative associations [21]. By integrating materiality into this debate, this study demonstrates that artefacts—prototypes, demonstrators, and testbeds—are not passive representations but performative actors that co-constitute legitimacy. This approach foregrounds the agency of materiality, moving beyond accounts that treat artefacts as neutral backdrops to rhetorical action [53]. These material practices enable proponents to mobilise resources, enrol stakeholders, and stabilise expectations, thereby shaping the development, scaling, and institutionalisation of emerging technologies. In advancing this, the paper reframes legitimacy as a dynamic, performative process where discursive and material practices are constitutively entangled [22,23]. The concept of *sociomaterial legitimation* thus offers a novel conceptual and analytical lens for examining how legitimacy is enacted, disrupted, and reconfigured over time through iterative interactions between discourses, materiality, and institutional arrangements. In doing so, it opens new avenues for exploring the role of material performances in sustaining innovation trajectories and navigating the paradoxes of legitimacy within sustainability transitions.

6. Conclusion

This paper has introduced the concept of sociomaterial legitimation to explain how emerging technologies gain and maintain legitimacy through the entangled performance of narratives and artefacts. The case of Heart Aerospace illustrates how such legitimacy is not stable, but continuously enacted, tested, and reconfigured. By foregrounding the agency of prototypes, demonstrators, and anchor events, the study highlights materiality as central to innovation trajectories. These insights offer new avenues for understanding sustainability transitions and call for more active institutional support to retain emerging industries.

Heart Aerospace provides a rich and timely case for exploring sociomaterial legitimation within a highly regulated and materially entrenched sector. Its innovation journey—marked by ambitious narratives, tangible artefacts, and strategic pivots—demonstrates how legitimacy is dynamically constructed and maintained through the entanglement of discursive and material practices. Yet the company's recent decision to relocate all operations to the United States also underscores the fragility of these processes, raising critical questions about how legitimacy fractures when original socio-technical foundations are disrupted.

Whilst this study offers valuable insights, its focus on a single case and reliance on publicly available data reflect deliberate scope choices. This approach enabled a detailed, longitudinal analysis of public-facing legitimation practices but did not capture internal organisational dynamics or contested stakeholder perspectives. Future studies could extend this work through insider–outsider approaches, integrating internal decision-making processes with external stakeholder engagements to provide a fuller picture of sociomaterial legitimation. Comparative research across industries and geographies could also test the analytical utility of the sociomaterial legitimation framework, exploring how sectoral characteristics and regulatory environments shape the entanglement of material and discursive practices. Finally, greater attention to consumer publics—whose perceptions and embodied experiences with prototypes, demonstrators, and testbeds may stabilise or destabilise innovation trajectories—remains an underexplored but vital frontier [98]. This is particularly urgent in commercial electric aviation, where public trust and perceptions of safety will play a pivotal role in determining whether sociomaterial legitimacy can be sustained over time.

CRediT authorship contribution statement

Emily Christley: Writing – review & editing, Writing – original draft, Visualization, Methodology, Investigation, Formal analysis, Conceptualization.

Declaration of Generative AI and AI-assisted technologies in the writing process

During the preparation of this work, I employed ChatGPT-4o in order to refine sentence structure and improve readability of the text, which I reviewed fully and edited as needed. I take full responsibility for the content of this paper.

Declaration of competing interest

The author declares that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A – full timeline

Date	Event
April 2018	Elektrisk Lufttransport i Sverige' (ELISE) research programme launches with funding from the Swedish Innovation Agency to develop electric aircraft in Sweden with 2018–2019 run time focusing on developing project ideas and collaboration between various actors
	Swedish Air Transport Society submits a roadmap for 'Fossil Free Aviation' to the government with the target that all domestic flights will be fossil free by 2030, and all flights departing from Swedish airports will be fossil free by 2045
October 2018	Heart Aerospace launches in Gothenburg as a spin-off from the ELISE research programme
May 2019	Heart Aerospace participates in the Y combinator start-up accelerator raising USD 2.1 M with lead investments from EQT Ventures and Norrsken Foundation
July 2019	Debate at Almedals Week 2019 'Swedish electric aviation – wishful thinking or realistic possibility?
September 2019	Nordic Network for Electric Aviation (NEA 1.0) launches as a platform for Nordic actors to accelerate the introduction of electric aviation with funding from Nordic Innovation with run time 2019–2023
	Heart Aerospace moves into Säve Airport in Gothenburg
November 2019	Green Flyway launches as an Interreg project to establish a test arena for electric and autonomous aircraft in the air corrideor between Røros (Norway) and Östersund (Sweden) with runtime until September 2022.
January 2020	Second stage of 'Elektrisk Lufttransport i Sverige' (ELISE 2.0) launches with funding from the Swedish Innovation Agency and runtime until July 2022. Heart Aerospace AB acts as coordinator with aim to work for the development and usage of electric aircraft in Sweden
May 2020	Finding innovations to Accelerate the Implementation of electric Regional aviation' (FAIR) project launches as a first step to prepare the Kvarken-Nordland region for electric aviation with runtime 2020–2022
June 2020	Skellefteå Airport launches project to support the commercialisation of electric aviation with additional financing from Skellefteå Kraft, Northvolt AB and EIT InnoEnergy
September 2020	Gothenburg Flying Club receives the first EASA type certified electric aircraft 'Pipistrel Velis Electro'
	Heart Aerospace receives EUR 2.5 M grant from European Investment Council as part of the European Green Deal
	Heart Aerospace demonstrates its first iteration of electric propulsion system including 400 kW electric motor, electric motor controller and battery pack integrated with BMS system
October 2020	Transport Analysis submit report (2020:12) to the government on the potential for electric aviation in Sweden, titled 'Electric aviation - the beginning of an exciting journey'
January 2021	The innovation cluster 'Fossil Free Air Transport 2045', renamed to 'Fossil Free Aviation 2045' publish final project report as a follow-up to the 2018 roadmap focusing on actions, obstacles, and needs to achieve market for liquid fuels, alternative technologies, and consumer markets
June 2021	Green Flight Academy launches in Skellefteå as a training school for pilots of electric aircraft
July 2021	Heart Aerospace receives purchase orders from United Airlines and Mesa Airlines for 200 ES-19 aircraft with an option for an additional 100 aircraft and raises USD 35 M Series A funding round led by Breakthrough Energy Ventures, United Airlines Ventures and Mesa Air Group Inc.
	Panel discussion at Almedals Week 2021 'When can we take an electric aircraft to Alemdalen?'
October 2021	All electric aircraft, Pipistrel Velis Electro, tours around Swedish regional airports in a 'elflygturné' to show case possibilities for the technology
December 2021	Heart Aerospace completes test flight on scale model (1:5) successful scale model of ES-19 aircraft at Säve Airport in Gothenburg
June 2022	The Swedish Transport Administration deliver the report 'We see the sky around the corner' to the government regarding state support for research and innovation into electric aviation
	Heart Aerospace change the certification basis for its first aircraft, the ES-19, to EASA Certification Specification CS-25 from CS-23 to optimize the product, reduce regulatory risk, and increase the accessible market
August 2022	All-electric aircraft, PureFlight U15 E Pheonix, tours around Swedish regional airports in a 'elflygturné' to showcase possibilities for the technology
September 2022	Heart Aerospace joins European Regions Airline Association (ERA)
	Heart Aerospace announces design updates to their ES-19 concept. The company will pursue a 30-seater hybrid-electric aircraft (ES-30) for commercial release by 2028
	Heart Aerospace announces Industry Advisory Board consisting of 21 members representing airlines, leasing companies, and airports
	Heart Aerospace announces plan to establish the world's first commercial electric aircraft industry at Säve Airport in Gothenburg
	Green Flyway publishes a final report having successfully demonstrated a test arena for electric and autonomous aircraft in the air corridor between Røros (Norway) and Östersund (Sweden)
October 2022	Heart Aerospace has received a total of 230 purchase orders (and 100 options) and 'letters of intent' for the purchase of 99 aircraft for the ES-30 aircraft
	Finding innovations to Accelerate the Implementation of electric Regional aviation' (FAIR) project finishes publishing a final report including recommendations for the implementation of electric aviation in the Kvarken-Nordland region
December 2022	EU Member States and the European Parliament agree to reform the inclusion of aviation in the EU Emissions Trading System (EU ETS), including the phasing out of the free allocation of emission rights to aviation within the EU ETS as early as 2026.
January 2023	Swedish Transport Administration to support research in electric aviation with SEK 15 M per year
February 2023	Swedish Energy Agency submits their report to the government on their investigation into a climate premium to support the market introduction of electric aircraft (ER 2023:05)
	Heart Aerospace announce that their plan to establish the world's first commercial electric aircraft industry will no longer be located at Säve Airport in Gothenburg
March 2023	Nordic Network for Electric Aviation funding extended (NEA 2.0) with run time 2023–2026
May 2023	Third stage of 'Elektrisk Lufttransport i Sverige' (ELISE 3.0) launches with funding from the Swedish Innovation Agency and runtime until April 2025. Heart Aerospace AB acts as coordinator to work for the goal of creating a full-scale demonstrator of Heart ES-30 to test taxiing and charging.
	All-electric aircraft, PureFlight U15 E Pheonix, tours around Swedish regional airports in a 'elflygturné' to showcase possibilities for the technology
	Swedish investment and aircraft leasing company Rockton make purchase order for 20 ES-30 with an purchase rights for 20 more
June 2023	Malmö Airport, owned by state-operator Swedavia announces that it shall become a test arena for full-scale models of ES-30 from Heart Aerospace also in partnership with airlines SAS and BRA and battery developer Northvolt and co-financed by the Swedish Innovation Agency
	Panel discussion at Almedals Week 2023 'A round trip to Gotland on an electric aircraft - it can become a reality'
	Heart Aerospace joins CAKE, Einride, and X Shore during Almedals Week in what is called an 'Electric Garden'
	Swedish Prime Minister Ulf Kristersson flies in a Pipistrel Velis Electro during Almedals Week
	SAS release air tickets for their first three flights to be operated with electric aircraft expected in 2028
	Finding innovations to Accelerate the Implementation of electric Regional aviation' (FAIR 2.0) project extends to continue FAIR 1.0 to prepare the Kvarken-Nordland region for electric aviation with runtime until November 2024.
July 2023	Swedish Member of European Parliament, Erik Bergkvist, launch own initiative on electric aviation as a solution for short- and mid-range flights (2023/2060 (INI))
August 2023	Heart Aerospace joins Region Airline Association (RRA)
September 2023	Swedish government decides to increase state operating subsidy to regional airports from SEK 103 M to SEK 2010 M
October 2023	Science Park Gotland join 'Network for electric aviation on Gotland' to arrange workshop on electric aviation 'Join us in taking electric aviation to new heights'

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Date	Event
February 2024	Heart Aerospace raise USD 107 M in Series B funding with Sagitta Ventures becoming a new investor, in addition to Air Canada, Breakthrough Energy Ventures, European Innovation Council Fund, EQT Ventures, Lower Capital, Norrsken VC, United Airlines, and Y Combinator, Heart Aerospace announce layoffs of one-third of their employees
May 2024	Heart Aerospace announces plans to open R&D hub in US, relocating its full-scale aircraft demonstrator to the US, and appointing a US based Chief Technical Officer
September 2024	Heart Aerospace completes ground support procedure tests for all-electric demonstrator at Säve Airport as part of ELISE 3.0. Heart Aerospace unveils full-scale all-electric demonstrator, X1, to serves as platform for testing and development Heart Aerospace granted USD 4.1 M from Federal Aviation Administrations 'Fueling Aviation's Sustainable Transitions' programme
November 2024	Heart Aerospace announces plans to conduct first fully electric flight of X1 demonstrator at Plattsburgh airport, New York
April 2025	Heart Aerospace announced total relocation to the US, with its corporate headquarters to be relocated to Los Angeles, California

Data availability

Data will be made available on request.

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